1B: Bioavailability of dissolved organic carbon produced by Thalassiosira weissflogii grown under different pCO2 and temperature conditions from UCSB Marine Science Institute Passow Lab from 2009 to 2010 (OA - Effects of High CO2 project)

Website: https://www.bco-dmo.org/dataset/471701
Data Type: experimental
Version: 1
Version Date: 2013-11-21

Project
» Will high CO2 conditions affect production, partitioning and fate of organic matter? (OA - Effects of High CO2)

Programs
» Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Abstract
Bioavailability of dissolved organic carbon produced by Thalassiosira weissflogii grown under different pCO2 and temperature conditions from UCSB Marine Science Institute Passow Lab from 2009 to 2010.

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Coverage

Spatial Extent: **Lat**:34.4126 **Lon**:-119.842
Temporal Extent: 2009 - 2010

Dataset Description

Data Set: 1B
3/14/2013
Mini Remin Exp

OA5 Bioavailability Exp 2013

Is there a significant difference in the bioavailability of organic matter produced by T. Weiss as a result of varied temperature and pCO2?

Does this organic matter become less available (higher C:N) as the phytos become more nutrient stressed?

Methods & Sampling

Treatments:
1. 20deg 400ppm 2 days post nutrient depletion
2. 20deg 400ppm 4 days post nutrient depletion
3. 20deg 400ppm 6 days post nutrient depletion
4. 20deg 1000ppm 2 days post nutrient depletion
5. 20deg 1000ppm 4 days post nutrient depletion
6. 20deg 1000ppm 6 days post nutrient depletion
7. 15deg 400ppm 2 days post nutrient depletion
8. 15deg 400ppm 4 days post nutrient depletion
9. 15deg 400ppm 6 days post nutrient depletion
10. 15deg 1000ppm 2 days post nutrient depletion
11. 15deg 1000ppm 4 days post nutrient depletion
12. 15deg 1000ppm 6 days post nutrient depletion

Set-up:
Sample:
1.4L: 80% 0.22um filtered from Jan Taucher's treatments (collected from March 9th (20deg 2day post nut depletion) to March 15th (15deg 6day post nut depletion))

0.3L: 20% 1.22um filtered campus point SW (collected 1000 on 03/16/2013)
Total volume per 2L PC bottle (treatment) = 1.5L

The total volume was combined at 1130 and then each 2L PC bottle (with 1.5L total volume) was split between duplicate 500ml PC bottles (the remaining volume was used for T0 sampling)

These bottles were then placed in the small incubator in the Chapman lab at 12 deg (same temperature of the innoclum during time of collection)

Sampling Schedule:
Time point Time (hrs) Date Time Samples Taken From what
T0 0 5/14/2013 930 DOC, FCM From 2L PC bottles
T1 5/15/2013 1230 FCM all 24
T2 5/16/2013 1210 FCM all 24
T3 3.5 5/17/2013 1100 DOC, FCM all 24
T4 5/18/2013 1400 FCM all 24
T5 5/19/2013 1030 FCM all 24
T6 148 5/20/2013 1330 FCM all 24
T7 160.75 5/21/2013 945 FCM all 24
T8 191 5/22/2013 1600 DOC, FCM all 24
TF ERH?? 6/6/2013 ERH?? DOC all 24

Data Processing Description

BCO-DMO Processing Notes
Original file: "AJames_Data.xlsx" Sheet: "OA5" contributed by Anna James
- Approx Lat/Lon of Passow Lab appended to enable data discovery in MapServer
- "nd" (no data) inserted into blank cells

- Parameter names edited to conform to BCO-DMO parameter naming conventions

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Data Files

File
DataSet1b_OA5_2013.csv (Comma Separated Values (.csv), 5.04 KB) MD5:baf0ad6ae4ea659c3e72ba192b19bfa7 Primary data file for dataset ID 471701

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Parameters

Parameter	Description	Units
Lab_Id	Lab Id – Lab identifier where experiments were conducted	text
Lat	Approximate Latitude Position of Lab; South is negative	decimal degrees
Lon	Approximate Longitude Position of Lab; West is negative	decimal degrees
Bottle_Num	PC bottle number sampled	dimensionless
Temp	Temperature	degrees C
pCO2	pCO2 conditions	ppm
days_post_nut_depletion	Days post nut depletion	days
DOC_T0_0	Dissolved Organic Carbon at T0 (0 hrs)	uM C
DOC_T2_70point5	Dissolved Organic Carbon at T2 (70.5 hrs)	uM C
DOC_T7_195	Dissolved Organic Carbon at T7 (195 hrs)	uM C
DOC_T10_284	Dissolved Organic Carbon at T10 (284 hrs)	uM C
DOC_TF_968point5	Dissolved Organic Carbon at TF (968.5 hrs)	uM C
FCM_T0_0	Bacteria as determined by flow cytometry at T0 (0 hrs)	cells/ml

FCM_T1_45	Bacteria as determined by flow cytometry at T1 45 hrs)	cells/ml
FCM_T2_70point5	Bacteria as determined by flow cytometry at T2 (70.5 hrs)	cells/ml
FCM_T3_97point5	Bacteria as determined by flow cytometry at T3 (97.5 hrs)	cells/ml
FCM_T4_117	Bacteria as determined by flow cytometry at T4 (117 hrs)	cells/ml
FCM_T5_142pont5	Bacteria as determined by flow cytometry at T5 (142.5 hrs)	cells/ml
FCM_T6_169point5	Bacteria as determined by flow cytometry at T6 (169.5 hrs)	cells/ml

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Deployments

lab_UCSB_MSI_Passow

Website	https://www.bco-dmo.org/deployment/58780
Platform	UCSB MSI Passow
Report	http://www.msi.ucsb.edu/people/research-scientists/uta-passow
Start Date	2009-09-01
End Date	2016-01-22
Description	Results form a series of controlled laboratory experiments investigating the effect of altered carbonate system chemistry on the abiotic formation of TEP

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Project Information

Will high CO2 conditions affect production, partitioning and fate of organic matter? (OA - Effects of High CO2)

Website: http://www.msi.ucsb.edu/people/research-scientists/uta-passow

Coverage: Passow Lab, Marine Science Institute, University of California Santa Barbara

From the NSF Award Abstract

Coastal waters are already experiencing episodic exposure to carbonate conditions that were not expected until the end of the century making understanding the response to these episodic events as important as understanding the long-term mean response. Among the most striking examples are those associated with coastal upwelling along the west coast of the US, where the pH of surface waters may drop to 7.6 and pCO2 can reach 1100 uatm. Upwelling systems are responsible for a significant fraction of global carbon export making them prime targets for investigations on how ocean acidification is already affecting the biological pump today.

In this study, researchers at the University of California at Santa Barbara will investigate the potential effects of ocean acidification on the strength of the biological pump under the transient increases in CO2 experienced due to upwelling. Increases in CO2 are expected to alter the path and processing of carbon through marine food webs thereby strengthening the biological pump. Increases in inorganic carbon without proportional increases in nutrients result in carbon over-consumption by phytoplankton. How carbon over-consumption affects the strength of the biological pump will depend on the fate of the extra carbon that is either incorporated into phytoplankton cells forming particulate organic matter (POM), or is excreted as dissolved organic matter (DOM). Results from mesocosm experiments demonstrate that the mechanisms controlling the partitioning of fixed carbon between the particulate and dissolved phases, and the processing of those materials, are obscured when both processes operate simultaneously under natural or semi-natural conditions. Here, POM and DOM production and the heterotrophic processing of these materials will be separated experimentally across a range of CO2 concentrations by conducting basic laboratory culture experiments. In this way the mechanisms whereby elevated CO2 alters the flow of carbon along these paths can be elucidated and better understood for use in mechanistic forecasting models.

Broader Impacts- The need to understand the effects of ocean acidification for the future of society is clear. In addition to research education, both formal and informal, will be important for informing the public. Within this project 1-2 graduate students and 2-3 minority students will be recruited as interns from the CAMP program (California Alliance for Minority Participation). Within the 'Ocean to Classrooms' program run by outreach personnel from UCSB's Marine Science Institute an educational unit for K-12 students will be developed. Advice and support is also given to the Education Coordinator of NOAA, Channel Islands National Marine Sanctuary for the development of an education unit on ocean acidification.

PUBLICATIONS PRODUCED AS A RESULT OF THIS RESEARCH

Arnosti C, Grossart H-P, Muehling M, Joint I, Passow U. "Dynamics of extracellular enzyme activities in seawater under changed atmsopheric pCO2: A mesocosm investigation.," Aquatic Microbial Ecology, v.64, 2011, p. 285.

Passow U. "The Abiotic Formation of TEP under Ocean Acidification Scenarios.," Marine Chemistry, v.128-129, 2011, p. 72.

Passow, Uta; Carlson, Craig A.. "The biological pump in a high CO2 world," MARINE ECOLOGY PROGRESS SERIES, v.470, 2012, p. 249-271.

Gaerdes, Astrid; Ramaye, Yannic; Grossart, Hans-Peter; Passow, Uta; Ullrich, Matthias S.. "Effects of Marinobacter adhaerens HP15 on polymer exudation by Thalassiosira weissflogii at different N:P ratios," MARINE ECOLOGY PROGRESS SERIES, v.461, 2012, p. 1-14.

Philip Boyd, Tatiana Rynearson, Evelyn Armstrong, Feixue Fu, Kendra Hayashi, Zhangi Hu, David Hutchins, Raphe Kudela, Elena Litchman, Margaret Mulholland, Uta Passow, Robert Strzepek, Kerry Whittaker, Elizabeth Yu, Mridul Thomas. "Marine Phytoplankton Temperature versus Growth Responses from Polar to Tropical Waters - Outcome of a Scientific Community-Wide Study," PLOS One 8, v.8, 2013, p. e63091.

Arnosti, C., B. M. Fuchs, R. Amann, and U. Passow. "Contrasting extracellular enzyme activities of particle-associated bacteria from distinct provinces of the North Atlantic Ocean," Frontiers in Microbiology, v.3, 2012, p. 1.

Koch, B.P., Kattner, G., Witt, M., Passow, U., 2014. Molecular insights into the microbial formation of marine dissolved organic matter: recalcitrant or labile? Biogeosciences Discuss. 11 (2), 3065-3111.

Taucher, J., Brzezinski, M., Carlson, C., James, A., Jones, J., Passow, U., Riebesell, U., submitted. Effects of warming and elevated pCO2 on carbon uptake and partitioning of the marine diatoms Thalassiosira weissflogii and Dactyliosolen fragilissimus. Limnology and Oceanography

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Program Information

Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

Website: https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503477

Coverage: global

NSF Climate Research Investment (CRI) activities that were initiated in 2010 are now included under Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES). SEES is a portfolio of activities that highlights NSF's unique role in helping society address the challenge(s) of achieving sustainability. Detailed information about the SEES program is available from NSF (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707).

In recognition of the need for basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future, the goal of the SEES: OA program is to understand (a) the chemistry and physical chemistry of ocean acidification; (b) how ocean acidification interacts with processes at the organismal level; and (c) how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean.

Solicitations issued under this program:
NSF 10-530, FY 2010-FY2011
NSF 12-500, FY 2012
NSF 12-600, FY 2013
NSF 13-586, FY 2014
NSF 13-586 was the final solicitation that will be released for this program.

PI Meetings:
1st U.S. Ocean Acidification PI Meeting(March 22-24, 2011, Woods Hole, MA)
2nd U.S. Ocean Acidification PI Meeting(Sept. 18-20, 2013, Washington, DC)
3rd U.S. Ocean Acidification PI Meeting (June 9-11, 2015, Woods Hole, MA – Tentative)

NSF media releases for the Ocean Acidification Program:

Press Release 10-186 NSF Awards Grants to Study Effects of Ocean Acidification

Discovery Blue Mussels "Hang On" Along Rocky Shores: For How Long?

Discovery nsf.gov - National Science Foundation (NSF) Discoveries - Trouble in Paradise: Ocean Acidification This Way Comes - US National Science Foundation (NSF)

Press Release 12-179 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: Finding New Answers Through National Science Foundation Research Grants - US National Science Foundation (NSF)

Press Release 13-102 World Oceans Month Brings Mixed News for Oysters

Press Release 13-108 nsf.gov - National Science Foundation (NSF) News - Natural Underwater Springs Show How Coral Reefs Respond to Ocean Acidification - US National Science Foundation (NSF)

Press Release 13-148 Ocean acidification: Making new discoveries through National Science Foundation research grants

Press Release 13-148 - Video nsf.gov - News - Video - NSF Ocean Sciences Division Director David Conover answers questions about ocean acidification. - US National Science Foundation (NSF)

Press Release 14-010 nsf.gov - National Science Foundation (NSF) News - Palau's coral reefs surprisingly resistant to ocean acidification - US National Science Foundation (NSF)

Press Release 14-116 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: NSF awards $11.4 million in new grants to study effects on marine ecosystems - US National Science Foundation (NSF)

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1041038

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