Calcium carbonate dissolution experiment Phase 2: Effect of elevated pCO2 and NO3- on sediment dissolution.

Website: https://www.bco-dmo.org/dataset/735834
Data Type: experimental
Version: 1
Version Date: 2018-05-11

Project
» Collaborative Research: Ocean Acidification and Coral Reefs: Scale Dependence and Adaptive Capacity (OA coral adaptation)

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

Contributors	Affiliation	Role
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Dataset Description

Effect of elevated pCO2 and NO3- on sediment dissolution. Data are results of Phase 2 of the sediment dissolution experiment described in:

Lantz, C. A., Carpenter, R. C. and Edmunds, P. J.: Calcium carbonate (CaCO3) sediment dissolution under elevated concentrations of carbon dioxide (CO2) and nitrate (NO3−). (2017) J. Exp. Mar. Bio. Ecol., 495, May, 48–56. doi: http://doi.org/10.1016/j.jembe.2017.05.014

The alkalinity anomaly technique was employed to measure changes in seawater total alkalinity inside of stirred benthic chambers. Water samples (75 mL) were taken at the beginning and end of each incubation from 0.6 cm diameter polyvinyl chloride in-line tubes connected to the side of the chamber, and these were used to measure seawater temperature, salinity, pH, and total alkalinity (TA). Temperature was recorded with a thermometer (± 0.05 ^{o}C; ThermoFisher Traceable®) and salinity was measured with a bench-top conductivity meter (± 0.1 psu, YSI® 3100). TA and pH were measured within one hour of sample collection. Seawater collected for TA was filtered (0.45 µm; Chanson and Millero, 2007) and analyzed using potentiometric titrations with 0.1-N HCl using an automatic titrator (Mettler Toledo T50) (Dickson et al., 2007). Seawater pH was measured as mV and temperature with a potentiometric electrode (Orion ROSS pH/ATC Triode) and converted to the total scale (pH_T) using a calibration relationship prepared using Tris-buffers (Nemzer and Dickson, 2005).

See the publication for a detailed overview of the methodology.

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Data Files

File
phase2_elevated_pCO2_NO3.csv (Comma Separated Values (.csv), 37.32 KB) MD5:4d2f406e5b1d78cb0eafa944203ba3bf Primary data file for dataset ID 735834

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Parameters

Parameter	Description	Units
Date	Date of experiment in format yyyy-mm-dd	no units
Flume	Flume number	no units
Chamber	Chamber number	no units
Target_pCO2	Target pCO2	uatm
day_night	Indicates whether incubation took place during day or night	no units
Target_nitrate	Target nitrate	uatm
Salinity	Salinity	psu
Clock1	Time at beginning of incubation; Hawaii Standard Time	no units
Temp1	Temperature at beginning of incubation	degrees celsius
mV1	Millivolts of seawater measured with a potentiometric probe at the start of the incubation	mV
TA1	Total alkalinity measured at the beginning of the incubation	umol/kg
pCO21	Partial pressure of CO2 measured at the beginning of the incubation	uatm
Clock2	Time at the end of the incubation; Hawaii Standard Time	no units
Temp2	Temperature measured at the end of the incubation	degrees Celsius

mV2	Millivolts of seawater measured at the end of the incubation	mV
TA2	Total alkalinity measured at the end of the experiment	umol/kg
pCO22	Partial presssure of CO2 measured at the end of the incubation	uatm
TA_corrected	Total alkalinity at the end of the experiment corrected for nutrients	umol/kg
Gnet	Calculated rate of net calcification as grams of CaCO3 per meter squared per day	per meter squared per day

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Instruments

Dataset-specific Instrument Name	Mettler Toledo T50
Generic Instrument Name	Automatic titrator
Generic Instrument Description	Instruments that incrementally add quantified aliquots of a reagent to a sample until the end-point of a chemical reaction is reached.

Dataset-specific Instrument Name	Orion ROSS pH/ATC Triode
Generic Instrument Name	Benchtop pH Meter
Generic Instrument Description	An instrument consisting of an electronic voltmeter and pH-responsive electrode that gives a direct conversion of voltage differences to differences of pH at the measurement temperature. (McGraw-Hill Dictionary of Scientific and Technical Terms) This instrument does not map to the NERC instrument vocabulary term for 'pH Sensor' which measures values in the water column. Benchtop models are typically employed for stationary lab applications.

Dataset-specific Instrument Name	ThermoFisher Traceable
Generic Instrument Name	digital thermometer
Generic Instrument Description	An instrument that measures temperature digitally.

Dataset-specific Instrument Name	YSI 3100
Generic Instrument Name	Salinity Sensor
Generic Instrument Description	Category of instrument that simultaneously measures electrical conductivity and temperature in the water column to provide temperature and salinity data.

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Project Information

Collaborative Research: Ocean Acidification and Coral Reefs: Scale Dependence and Adaptive Capacity (OA coral adaptation)

Website: http://mcr.lternet.edu

Coverage: Moorea, French Polynesia

Extracted from the NSF award abstract:

This project focuses on the most serious threat to marine ecosystems, Ocean Acidification (OA), and addresses the problem in the most diverse and beautiful ecosystem on the planet, coral reefs. The research utilizes Moorea, French Polynesia as a model system, and builds from the NSF investment in the Moorea Coral Reef Long Term Ecological Research Site (LTER) to exploit physical and biological monitoring of coral reefs as a context for a program of studies focused on the ways in which OA will affect corals, calcified algae, and coral reef ecosystems. The project builds on a four-year NSF award with research in five new directions: (1) experiments of year-long duration, (2) studies of coral reefs to 20-m depth, (3) experiments in which carbon dioxide will be administered to plots of coral reef underwater, (4) measurements of the capacity of coral reef organisms to change through evolutionary and induced responses to improve their resistance to OA, and (5) application of emerging theories to couple studies of individual organisms to studies of whole coral reefs. Broader impacts will accrue through a better understanding of the ways in which OA will affect coral reefs that are the poster child for demonstrating climate change effects in the marine environment, and which provide income, food, and coastal protection to millions of people living in coastal areas, including in the United States.

This project focuses on the effects of Ocean Acidification on tropical coral reefs and builds on a program of research results from an existing 4-year award, and closely interfaces with the technical, hardware, and information infrastructure provided through the Moorea Coral Reef (MCR) LTER. The MCR-LTER, provides an unparalleled opportunity to partner with a study of OA effects on a coral reef with a location that arguably is better instrumented and studied in more ecological detail than any other coral reef in the world. Therefore, the results can be both contextualized by a high degree of ecological and physical relevance, and readily integrated into emerging theory seeking to predict the structure and function of coral reefs in warmer and more acidic future oceans. The existing award has involved a program of study in Moorea that has focused mostly on short-term organismic and ecological responses of corals and calcified algae, experiments conducted in mesocosms and flumes, and measurements of reef-scale calcification. This new award involves three new technical advances: for the first time, experiments will be conducted of year-long duration in replicate outdoor flumes; CO2 treatments will be administered to fully intact reef ecosystems in situ using replicated underwater flumes; and replicated common garden cultivation techniques will be used to explore within-species genetic variation in the response to OA conditions. Together, these tools will be used to support research on corals and calcified algae in three thematic areas: (1) tests for long-term (1 year) effects of OA on growth, performance, and fitness, (2) tests for depth-dependent effects of OA on reef communities at 20-m depth where light regimes are attenuated compared to shallow water, and (3) tests for beneficial responses to OA through intrinsic, within-species genetic variability and phenotypic plasticity. Some of the key experiments in these thematic areas will be designed to exploit integral projection models (IPMs) to couple organism with community responses, and to support the use of the metabolic theory of ecology (MTE) to address scale-dependence of OA effects on coral reef organisms and the function of the communities they build.

The following publications and data resulted from this project:

Comeau S, Carpenter RC, Lantz CA, Edmunds PJ. (2016) Parameterization of the response of calcification to temperature and pCO2 in the coral Acropora pulchra and the alga Lithophyllum kotschyanum. Coral Reefs 2016. DOI 10.1007/s00338-016-1425-0.
calcification rates (2014)
calcification rates (2010)

Comeau, S., Carpenter, R.C., Edmunds, P.J. (2016) Effects of pCO2 on photosynthesis and respiration of tropical scleractinian corals and calcified algae. ICES Journal of Marine Science doi:10.1093/icesjms/fsv267.
respiration and photosynthesis I
respiration and photosynthesis II

Evensen, N.R. & Edmunds P. J. (2016) Interactive effects of ocean acidification and neighboring corals on the growth of Pocillopora verrucosa. Marine Biology, 163:148. doi: 10.1007/s00227-016-2921-z
coral growth
seawater chemistry
coral colony interactions

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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)

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1415268

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