Experimental tank parameters throughout the life of Clathromorphum compactum and C. nereostratum calcification experiment from from 2015-2016 (CorallineAlgaePaleo-pH project)

Website: https://www.bco-dmo.org/dataset/872498
Data Type: experimental
Version: 1
Version Date: 2022-04-04

Project
» Collaborative Research: Development and application of a method using coralline algae to reconstruct past changes in pH and impacts on calcification (CorallineAlgaePaleo-pH)

Contributors	Affiliation	Role
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Abstract
Regularly measured tank conditions (pH, Temperature, Salinity). measured three times per week throughout the life of Clathromorphum compactum and C. nereostratum calcification experiment (https://www.bco-dmo.org/dataset/871633). pCO2 was calculated every ~14 days from water samples.

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Coverage

Temporal Extent: 2015-10-08 - 2016-02-09

Methods & Sampling

Methodology:

Sampling and analytical procedures:

C. compactum and *C. nereostratum* cultured for 4 months under 12 pCO2/T treatments in thirty-six, 42-liter aquaria.

Seawater samples were obtained every ~14 days using 250 mL ground-glass-stoppered borosilicate glass bottles for measurement of total alkalinity (TA) and dissolved inorganic carbon (DIC) and other carbonate parameters.

Temp, salinity, pH measured three times weekly.

For buoyant weight, specimens were suspended beneath a balance in an aquarium at 4 cm depth in seawater of constant temperature and salinity.

Specimens were dosed with calcein before the experiment and the vertical growth was determined by measuring the vertical growth from the resulting calcein line to the surface.

Data Processing Description

CO2Sys used to calculate all carbonate parameters, including pCO2.

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Data Files

File	
Salinity_Temp_PCO2_tank_parameters.csv	(Comma Separated Values (.csv), 97.79 KB) MD5:1c9da6167e9082edb27b2b9393c81089
Primary data file for dataset ID 872498	

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Related Publications

Westfield, I., Gunnell, J., Rasher, D. B., Williams, B., & Ries, J. B. (2022). Cessation of Hardground Accretion by the Cold-Water Coralline Algae Clathromorphum Compactum and Clathromorphum Nereostratum Predicted Within Two Centuries. Geochemistry, Geophysics, Geosystems, 23(5). Portico. https://doi.org/10.1029/2021gc009942 https://doi.org/10.1029/2021GC009942
Results

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Related Datasets

IsReferencedBy

Westfield, I., Ries, J. B., Williams, B., Rasher, D. B. (2022) **Clathromorphum compactum and C. nereostratum calcification experiment data involving multiple temperatures and pCO2 levels (CorallineAlgaePaleo-pH).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-04-04 doi:10.26008/1912/bco-dmo.871633.1 [view at BCO-DMO]
Relationship Description: These tank conditions were measured during the experiments represented by the dataset "Crustose coralline algae calcification experiment data" (871633).

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Parameters

Parameter	Description	Units
Date	Date of sampling measurement	unitless
Mean_pCO2	Mean pCO2 of experimental tank	uatm
Mean_Temp	Mean temperature of experimental tank	degrees Celsius
Mean_pH	Mean pH of experimental tank	unitless
Tank	Tank number within a temperature/pCO2 combination	unitless
Group_ID	Cominations of experimental conditions and Tank number used to create a unique identifier for groups within the experiment	unitless
Salinity	Salinity of the experimental tank	psu
Temp	Temperature of the experimental tank	degrees Celsius
pCO2	pCO2 of the experimental tank	uatm
pH	pH of the experimental tank	unitless

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Instruments

Dataset-specific Instrument Name	VINDTA 3C (Marianda Corporation, Kiel, Germany)
Generic Instrument Name	MARIANDA VINDTA 3C total inorganic carbon and titration alkalinity analyser
Dataset-specific Description	Measures total alkalinity and DIC using closed-cell potentiometric Gran titration and coulometry (UIC 5400), with both methods calibrated using certified Dickson DIC/TA standards.
Generic Instrument Description	The Versatile INstrument for the Determination of Total inorganic carbon and titration Alkalinity (VINDTA) 3C is a laboratory alkalinity titration system combined with an extraction unit for coulometric titration, which simultaneously determines the alkalinity and dissolved inorganic carbon content of a sample. The sample transport is performed with peristaltic pumps and acid is added to the sample using a membrane pump. No pressurizing system is required and only one gas supply (nitrogen or dry and CO2-free air) is necessary. The system uses a Metrohm Titrino 719S, an ORION-Ross pH electrode and a Metrohm reference electrode. The burette, the pipette and the analysis cell have a water jacket around them. Precision is typically +/- 1 umol/kg for TA and/or DIC in open ocean water.

Dataset-specific Instrument Name	AccuFet™ Solid-State pH probe
Generic Instrument Name	pH Sensor
Dataset-specific Description	AccuFet™ Solid-State pH probe, calibrated with 7.00 and 10.01 NBS buffers (for slope of calibration) and a Dickson Lab DIC/TA standard (for y-intercept of calibration).
Generic Instrument Description	An instrument that measures the hydrogen ion activity in solutions. The overall concentration of hydrogen ions is inversely related to its pH. The pH scale ranges from 0 to 14 and indicates whether acidic (more H+) or basic (less H+).

Dataset-specific Instrument Name	High precision partial-immersion glass thermometer
Generic Instrument Name	Thermometer
Dataset-specific Description	High precision partial-immersion glass thermometer (precision ±0.3%; accuracy ±0.4%).
Generic Instrument Description	A device designed to measure temperature.

Dataset-specific Instrument Name	YSI 3200 (Yellow Springs, Ohio, USA)
Generic Instrument Name	YSI Professional Plus Multi-Parameter Probe
Dataset-specific Description	YSI 3200 (Yellow Springs, Ohio, USA) conductivity probe with a cell constant of k = 10.
Generic Instrument Description	The YSI Professional Plus handheld multiparameter meter provides for the measurement of a variety of combinations for dissolved oxygen, conductivity, specific conductance, salinity, resistivity, total dissolved solids (TDS), pH, ORP, pH/ORP combination, ammonium (ammonia), nitrate, chloride and temperature. More information from the manufacturer.

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Project Information

Collaborative Research: Development and application of a method using coralline algae to reconstruct past changes in pH and impacts on calcification (CorallineAlgaePaleo-pH)

Coverage: Marine Science Center, Northeastern University; and Keck Science Department, Claremont Colleges

Description from NSF award abstract:
The impacts of recent and future human-caused increases in atmospheric CO2 on the acidity (pH) of shallow cold-water marine environments (a process known as "ocean acidification"), and on the organisms that inhabit them, are poorly understood. This is due, in part, to the difficulty in reconstructing past changes in ocean chemistry in these remote environments. This research seeks to develop and apply a technique to reconstruct past seawater pH from boron isotope signatures in long-lived crustose coralline alga that are widespread throughout shallow, cold-water marine environments. In addition, the research will evaluate the impact of changing seawater pH on the growth rate of these ecologically important organisms, which are thought to be particularly vulnerable to ocean acidification because of the high magnesium content of their skeleton. Overall, this project will advance understanding of ocean acidification in shallow, cold-water environments, and provide key information to evaluate the impact that changes in ocean pH have had on organisms inhabiting these environments. The outcomes of this work will provide important information to policy makers and legislators seeking to mitigate the negative effects of rising atmospheric CO2 on these fragile, high-latitude marine ecosystems.

Funding supports a graduate student, numerous undergraduate researchers, and a new collaboration between two early career faculty members. Outreach includes mentoring high school students from groups underrepresented in the sciences through the Scripps College Academy and production of an educational film on the biological impacts of ocean acidification. The research team will strengthen international ties through collaboration with Canadian and UK scientists, while helping maintain US-based scientists at the forefront of this important sub-field of ocean acidification research.

The work plan includes three main parts: (1) developing the first laboratory-derived and field-verified calibration

of the delta11B-proxy of paleoseawater pH for coralline algae, (2) generating the first high-resolution, multi-centennial dataset of high-latitude seawater pH before (ca. 1365 to 1760 AD; i.e., "baseline") and after (ca. 1760 AD to present; i.e., "anthropogenic signal") the Industrial Revolution, and (3) evaluating the impact of anthropogenic ocean acidification on the linear extension, density, and ultrastructure of skeletons produced by an ecologically important, habitat-forming coralline red alga. The associated objectives are: (1) to provide a new tool for reconstructing paleo-seawater pH, (2) to generate historical records of ocean acidification that would elucidate the rate and magnitude of high-latitude ocean acidification that could be used to verify predictive models, and (3) to establish empirical relationships between ocean acidification and coralline algal calcification that would inform predictions of future impacts of ocean acidification on high-latitude marine calcifiers.

Additional information may be found on the following lab websites:
Ries Lab - http://nuweb2.neu.edu/rieslab/
Williams Marine Environmental Change (MEC) Lab - https://branwenwilliams.com/

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Funding

Funding Source	Award
NSF Arctic Sciences (NSF ARC)	PLR-1316141
NSF Division of Ocean Sciences (NSF OCE)	OCE-1459706
NSF Division of Ocean Sciences (NSF OCE)	OCE-1459827

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