Calcification rates for experiments investigating impact of ocean acidification on coral (S. siderea) calcification and morphometry.

Website: https://www.bco-dmo.org/dataset/722025
Data Type: experimental
Version: 1
Version Date: 2017-12-28

Project
» A combined boron isotope, pH microelectrode and pH-sensitive dye approach to constraining acid/base chemistry in the calcifying fluids of corals (CoralCalcifyFluid_pH)

Contributors	Affiliation	Role
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Dataset Description

Dry weight, buoyant weight, and surface area data for the *S. siderea* coral specimens investigated for the study: Impact of ocean acidification on coral (Siderastrea siderea) calcification and corallite morphology. Dry weights were calculated using the empirically derived buoyant weight-dry weight regression equations.

See also related datasets for seawater chemistry and *Siderastrea siderea* corallite morphometry:
Seawater chemistry
Corallite morphometry

Data are published in:

Horvath, K.M., Ries, J.B., Castillo, K.D., Westfield, I.T., Armstrong, P., Courtney, T., 2016, Next-century ocean acidification and warming both reduce calcification rate, but only acidification alters skeletal morphology of reef-building coral *Siderastrea siderea*. Scientific Reports 6: 29613. doi: 10.1038/srep29613

Please see manuscript for complete methodology.

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Data Files

File
722025.csv (Comma Separated Values (.csv), 9.44 KB) MD5:cdd9e197bb4fb5096383b29799c84c59 Primary data file for dataset ID 722025

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Parameters

Parameter	Description	Units
Treatment_temp	Temperature for the treatment (experimental condition)	degrees Celsius
Treatment_CO2	CO2 concentration for the treatment (experimental condition)	ppm-v
Replicate	Replicate tank number	1,2,3
Colony	Colony	unknown
Buoyant_weight_0d	Buoyant weight measured at 0 days	mg
Buoyant_weight_30d	Buoyant weight measured at 30 days	mg
Buoyant_weight_60d	Buoyant weight measured at 60 days	mg
Dry_weight_0d	Dry weight measured at 0 days	mg
Dry_weight_30d	Dry weight measured at 30 days	mg
Dry_weight_60d	Dry weight measured at 60 days	mg
Surface_area	Surface area of specimen	square centimenters
Calc_rate_0_30d	Calcification rate normalized to surface area for days 0-30	mg per square centimenter
Calc_rate_30_60d	Calcification rate normalized to surface area for days 30-60	mg per square centimeter
Calc_rate_0_60d	Calcification rate normalized to surface area for days 0-60	mg per square centimeter

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Project Information

A combined boron isotope, pH microelectrode and pH-sensitive dye approach to constraining acid/base chemistry in the calcifying fluids of corals (CoralCalcifyFluid_pH)

Website: http://nuweb2.neu.edu/rieslab/

Coverage: Marine Science Center, Northeastern University

Description from NSF award abstract:
The anthropogenic elevation of atmospheric CO2 is causing the oceans to become more acidic, which may make it more challenging for corals to build their skeletons and, ultimately, entire reef structures. How corals respond to future ocean acidification will largely depend on how the pH of the internal fluid from which they produce their skeletons-their so-called calcifying fluid-is impacted by the surrounding seawater. It is therefore essential that current methods are refined to accurately measure the pH of corals' calcifying fluids in order to understand and, ideally, predict their responses to CO2-induced ocean acidification. In this project, a three-pronged approach to measure calcifying fluid pH within three species of reef-forming corals will be used to assess how their calcifying fluid pH responds to experimentally induced ocean acidification. This research will improve our understanding of corals' responses to ocean acidification and thus has the potential to inform the decisions of policy makers and legislators seeking to mitigate the deleterious effects of rising atmospheric CO2 on marine ecosystems. The work will support the development of three early career scientists, a postdoctoral fellow, graduate students, and undergraduate researcher assistants-several of whom are from underrepresented groups in the earth and ocean sciences. Results will be widely disseminated through publications, conference presentations, the PIs' websites, an educational film, coursework, and outreach activities at area schools, museums, and science centers.

Corals and other types of marine calcifiers are thought to begin the mineralization of their calcium carbonate skeletons by actively elevating pH of their calcifying fluid, thereby converting bicarbonate ions (comprising ~90% of seawater dissolved inorganic carbon) to carbonate ions, the form of carbon used in calcification. This project will compare the combined boron isotope, pH microelectrode, and pH-sensitive dye approach to

measure the calcifying fluid pH of three species of scleractinian corals, and to assess how their calcifying fluid pH (a primary factor controlling their calcification) responds to experimentally induced ocean acidification. As a result this multi-pronged approach to measuring calcifying fluid pH of the same coral species under equivalent culturing conditions will permit the first systematic cross-examination of the validity of these independent approaches. The combined approach will also yield values of calcifying fluid pH with uncertainties that can be quantified via inter-comparison and statistical treatment of these independent measurements. Importantly, this multi-pronged approach will be used on three coral species that due to differences in the carbonate chemistry of their native waters possess differing capacities for proton regulation at their site of calcification; a deep, cold-water coral (strong proton-pumper); a shallow, temperate coral (moderate proton-pumper); and a shallow, tropical coral (weak proton-pumper). Target outcomes of this research include (1) cross-examination of the validity of three independent approaches to estimating coral calcifying fluid pH, (2) quantification of uncertainty associated with the three approaches to estimating coral calcifying fluid pH, (3) advancement of our mechanistic understanding of coral calcification, (4) exploration of the mechanism by which ocean acidification impacts coral calcification, (5) elucidation why corals exhibit such varied responses to ocean acidification, (6) identification of coral types most vulnerable to ocean acidification, (7) exploration of so-called "vital effects" that limit the use of corals in paleoceanographic reconstructions, and (8) quantitative constraint of existing models of coral biomineralization.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357665
NSF Division of Ocean Sciences (NSF OCE)	OCE-1437371
NSF Division of Ocean Sciences (NSF OCE)	OCE-1459706

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