

Estimated gross dissolution rates, previously derived net calcification rates, and estimated gross calcification rates for eight species of marine calcifiers at 25.0 °C.

Website: <https://www.bco-dmo.org/dataset/723866>

Data Type: experimental

Version: 1

Version Date: 2018-01-17

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
Ries, Justin B.	Northeastern University	Principal Investigator
Switzer, Megan	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	Data Manager

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Dataset Description

Estimated gross dissolution rates (this study), previously derived net calcification rates (Ries et al., 2009 – all species except *S. siderea*; Castillo et al., 2014 – *S. siderea*), and estimated gross calcification rates (net calcification minus gross dissolution) for eight species of marine calcifiers at 25.0 °C (± 0.02) at Ω_A employed by Ries et al. (2009) and Castillo et al. (2014).

References:

Castillo K.D., Ries J.B., Bruno J.F., Westfield I.T., 2014, The reef-building coral *Siderastrea siderea* exhibits parabolic responses to ocean acidification and warming, Proceedings of the Royal Society of London B 281: 20141856. doi: [10.1098/rspb.2014.1856](https://doi.org/10.1098/rspb.2014.1856)

Ries, J.B., Cohen, A.L., McCorkle, D.C., 2010, A nonlinear calcification response to CO₂-induced ocean acidification by the coral *Oculina arbuscula*, Coral Reefs 29: 661-674.

These data are published in:

Ries, J.B., Ghazaleh, M.N., Connolly, B., Westfield, I., Castillo, K.D., 2016, Impacts of ocean acidification and warming on the dissolution kinetics of whole-shell biogenic carbonates. Geochimica et Cosmochimica Acta 192: 318–337. doi: [10.1016/j.gca.2016.07.001](https://doi.org/10.1016/j.gca.2016.07.001)

Please see manuscript for complete methodology.

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Data Files

File
723866.csv (Comma Separated Values (.csv), 3.56 KB) MD5:c4f5ca2d8fd362d7117d302453dc3227
Primary data file for dataset ID 723866

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Parameters

Parameter	Description	Units
Specimen	Specimen	name
Scientific_name	Scientific name	name
Arag_sat	Aragonite saturation state of seawater employed by Ries et al. (2009) and Castillo et al. (2014)	omega
g_diss_regression	?	?
g_diss	?	?
net_calc_rate	?	?
calculated_g_calc	?	?

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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-1437371
NSF Division of Ocean Sciences (NSF OCE)	OCE-1459706

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