Stable isotopic composition of aragonite from cultured coral (O. arbuscula) grown at 25 degrees C and other measured variables.

Website: https://www.bco-dmo.org/dataset/721780
Version:
Version Date: 2017-12-20

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)

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Table of Contents

- Dataset Description
- Data Files
- Parameters
- Instruments
- Project Information
- Funding

Dataset Description

Dataset includes measured values for dO18, and d47 generated from phosphoric acid digestion of carbonates in selected coral samples.

Data are published in:

Tripati, A.K., Hill, P.S., Eagle, R.A., Mosenfelder, J.L., Tang, J., Schauble, E.A., Eiler, J.M., Zeebe, R.E., Uchikawae, J., Coplen, T.B., Ries, J.B., Henry, D., 2015, Beyond temperature: Clumped isotope signatures in dissolved inorganic carbon species and the influence of solution chemistry on carbonate mineral composition. Geochimica et Cosmochimica Acta 166: 344-371. DOI: 10.1016/j.gca.2015.06.021

Please see manuscript for complete methodology.

[table of contents | back to top]

Data Files

File
721780.csv (Comma Separated Values (.csv), 952 bytes) MD5:f79cd9926c52932c4e0f383083a0ed8f Primary data file for dataset ID 721780

[table of contents | back to top]

Parameters

Parameter	Description	Units
Sample_ID	Sample ID	no units
number_analyses	Number of analyses performed on given sample	number
d18O	Average delta O-18 of CO2 generated from phosphoric acid digestion of carbonates	per mil (VPDB)
SE_1_d18O	unknown	unknown
d47	Average delta 47 of CO2 generated from phosphoric acid digestion of carbonates	per mil (ARF)
SE_1_d47	unknown	unknown
pH	pH	no units (pH scale)
SE_1_pH	unknown	unknown
pCO2	CO2 concentration	ppm
SD_pCO2	unknown	unknown
CO3	unknown	unknown
SD_CO3	unknown	unknown
HCO3	unknown	unknown
SD_HCO3	unknown	unknown
arag_sat	unknown	unknown
SD_arag_sat	unknown	unknown
DIC	unknown	unknown
SD_DIC	unknown	unknown

calcification_rate	Calcification rate measured as percent change over 60 days	percent
Linear_Extension	unknown	unknown

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Thermo Scientific MAT 253 gas-source mass spectrometers based at Caltech and UCLA
Generic Instrument Name	Mass Spectrometer
Generic Instrument Description	General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components.

[table of contents | back to top]

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.

[table of contents | back to top]

Funding

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

[table of contents | back to top]