# Skeletal density for crustose coralline algae reared in natural and experimental temperature and pCO2 conditions

**Website**: https://www.bco-dmo.org/dataset/836975
**Data Type**: experimental
**Version**: 1
**Version Date**: 2021-01-21

**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**
This dataset contains skeletal density for crustose coralline algae reared in natural and experimental conditions (factorially crossed temperature (~6.5, 8.5, and 12.5 °C) and pCO2 (~350, 490, 890, and 3200 µatm)). Skeletal density was quantified using a micro-CT scanner.

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## Coverage

**Temporal Extent**: 2015 - 2016

### Methods & Sampling

This dataset contains skeletal density in crustose coralline algae cultured in experimental conditions (factorially crossed temperature (~6.5, 8.5, and 12.5 °C) and pCO2 (~350, 490, 890, and 3200 µatm)). The experiment was run for 125 days, starting in October 2015.

Skeletal density was quantified using Micro-CT imaging conducted at the Preclinical Imaging Research Centre (PIRC), Robarts Research Institute, University Of Western Ontario, using a micro-CT scanner (GE Healthcare, eXplore Locus RS-9) at a peak x-ray energy of 80 kVp and a tube current of 450 uA.

Specimens used in the experiments were collected from the Gulf of Maine (44.431591 N, -68.121289 E) and Adak Island, Alaska (51.784143 N, -176.432640 E).

### Data Processing Description

BCO-DMO Processing:
- replaced spaces with underscores in parameter names;
- rounded Density column to two decimal places.

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## Data Files

| File |
|---|
| **coral_density.csv** (Comma Separated Values (.csv), 27.28 KB)<br>MD5:13d8efba5d32eb4e754ea1ae3e460f11<br>Primary data file for dataset ID 836975 |

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## Parameters

| Parameter | Description | Units |
|---|---|---|
| Species | Species: Either Clathromorphum compactum or Clathromorphum nereostratum | unitless |
| Specimen_ID | Identification number assigned to specimen | unitless |
| Temp | Temperature treatment value | degrees Celsius |
| pCO2 | pCO2 treatment value | microatmospheres (µatm) |
| Location | Location of measurement, either in cultured skeleton or skeleton formed in the wild prior to collection for the experiment | unitless |
| Tank | The tank number: three tanks per temperature x pCO2 conditions | unitless |
| Subsample | Two to four measurements per location in each specimen | unitless |
| Density | Skeletal density in mg/cc | milligrams per cubic centimeter (mg/cc) |

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | micro-CT scanner |
| **Generic Instrument Name** | Computerized Tomography (CT) Scanner |
| **Dataset-specific Description** | Skeletal density quantified using Micro-CT imaging conducted at the Preclinical Imaging Research Centre (PIRC), Robarts Research Institute, University Of Western Ontario, using a micro-CT scanner (GE Healthcare, eXplore Locus RS-9) at a peak x-ray energy of 80 kVp and a tube current of 450 uA |
| **Generic Instrument Description** | A CT scan makes use of computer-processed combinations of many X-ray measurements taken from different angles to produce cross-sectional (tomographic) images (virtual "slices") of specific areas of a scanned object. |

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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 Division of Ocean Sciences (NSF OCE) | OCE-1459827 |

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