

# Boron and Calcium geochemistry of mussel larvae bulk material, 2014-2015 (OA\_Proxies project)

**Website:** <https://www.bco-dmo.org/dataset/518419>

**Data Type:** experimental

**Version:** 1

**Version Date:** 2015-07-07

## Project

» [Development of geochemical proxies to evaluate larval pH-exposure history](#) (OA\_Proxies)

## Program

» [Science, Engineering and Education for Sustainability NSF-Wide Investment \(SEES\): Ocean Acidification \(formerly CRI-OA\)](#) (SEES-OA)

| Contributors                       | Affiliation  | Role                   |
|------------------------------------|--|------------------------|
| <a href="#">Herrmann, Achim D.</a> | Louisiana State University Coastal Studies Institute (LSU-CSI) | Principal Investigator |
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## Abstract

These data are 11-Boron and 43-Calcium values from mass spectrometer runs of mussel larvae shells, conducted on 4 Jan. 2014 and 1 June 2015.

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## Dataset Description

These data are 11-Boron and 43-Calcium values from mass spectrometer runs of mussel larvae shells, conducted on 4 Jan. 2014 and 1 June 2015.

## Methods & Sampling

The concentrations of B and Ca in each mussel were analyzed using a laser ablation inductively coupled plasma mass spectrometer (LA-ICPMS; Cetac LSX-213; 213 nm laser coupled to an iCap Qc ICPMS) located in the Department of Geology and Geophysics at Louisiana State University. Boron isotopes of bulk mussel larvae and additional B/Ca ratios were measured in the Secondary Ion Mass Spectrometry Labs at Arizona State University using a Cameca IMS 3F.

Mussel larvae were obtained from Scripps where they were cultured in bulk.

## Data Processing Description

LA-ICPMS data can be evaluated using Lolite. SIMS data was evaluated using an instrument fractionation factor as established from Bahamian carbonates.

#### Versions:

Version 2015-07-07 includes runs from 2014 and 2015.

Version 2014-07-03 includes runs from 2014.

#### BCO-DMO Data Processing:

In order to serve on the BCO-DMO system, these changes were made to the originally submitted files:

- headers were split off from data
- removed commas at end of each record
- parameter names starting with numbers were changed.
- added columns for date, run, sample, and time\_start

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## Data Files

| File  |
|---|
| <b>mussel_CaB_all.csv</b> (Comma Separated Values (.csv), 14.18 MB)<br>MD5:ce1ff333d4bae2f432673d5211c80014 |
| Primary data file for dataset ID 518419   |

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## Supplemental Files

| File   |
|--|
| <b>SIMS results table: Secondary Ion Mass Spectrometry</b><br>filename: Hermann_SIMS_data_3July2014.pdf(Portable Document Format (.pdf), 57.29 KB)<br>MD5:4504cb9efc0d344f06104ae396335c35 |

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## Related Datasets

### IsSupplementedBy

Herrmann, A. D. (2015) **Mass spec headers for Boron and Calcium geochemistry of mussel larvae bulk material, 2014-2015 (OA\_Proxies project)**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2015-07-08) Version Date 2015-07-08 <http://lod.bco-dmo.org/id/dataset/518621> [[view at BCO-DMO](#)]

*Relationship Description: These data are the headers from the mass spectrometer runs of mussel larvae shells, conducted on 4 Jan. 2014 and 1 June 2015.*

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## Parameters

| Parameter  | Description                                  | Units                   |
|------------|--|-------------------------|
| date       | date of analysis                             | yyyymmdd                |
| run        | mass spec run id                             | unitless                |
| sample     | sample identification                        | unitless                |
| time_start | time at start of mass spec run               | HH:MM:SS                |
| Time       | acquisition duration                         | seconds                 |
| B11        | concentration of 11-Boron in mussel larvae   | atomic mass units (AMU) |
| Ca43       | concentration of 43-Calcium in mussel larvae | atomic mass units (AMU) |

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## Instruments

|   |  |
|---|--|
| <b>Dataset-specific Instrument Name</b> | ICP Mass Spec  |
| <b>Generic Instrument Name</b>          | Inductively Coupled Plasma Mass Spectrometer   |
| <b>Dataset-specific Description</b>     | LA-ICPMS; Cetac LSX-213; 213 nm laser coupled to an iCap Qc ICPMS located in the Department of Geology and Geophysics at Louisiana State University.   |
| <b>Generic Instrument Description</b>   | An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer. |

|   |   |
|---|---|
| <b>Dataset-specific Instrument Name</b> | Mass Spec   |
| <b>Generic Instrument Name</b>          | Mass Spectrometer   |
| <b>Dataset-specific Description</b>     | Cameca IMS 3F located at the Secondary Ion Mass Spectrometry Labs at Arizona State University   |
| <b>Generic Instrument Description</b>   | 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. |

## Deployments

### Herrmann\_lab

|                    |   |
|--------------------|---|
| <b>Website</b>     | <a href="https://www.bco-dmo.org/deployment/561000">https://www.bco-dmo.org/deployment/561000</a> |
| <b>Platform</b>    | lab LSU   |
| <b>Start Date</b>  | 2014-01-01  |
| <b>End Date</b>    | 2015-06-30  |
| <b>Description</b> | Elemental analyses of organisms   |

## Project Information

### Development of geochemical proxies to evaluate larval pH-exposure history (OA\_Proxies)

**Coverage:** Southern California, 32 N 117 W

This research is funded as part of NSF CRI Ocean Acidification Category 2. The investigators will develop a new interdisciplinary partnership between connectivity ecology (Levin at SIO), metal isotope geochemistry (Anbar and Gordon at ASU), and paleoclimatology (Herrmann at ASU/LSU) to identify new proxies for ocean acidification that can be used to assess pH exposures in living organisms and, potentially to interpret the geologic record. The investigators hypothesize that the isotopic composition of larval calcium carbonates reflects changes in seawater chemistry driven by ocean acidification and, in some instances, with associated decline in oxygen levels. The large extent to which these two parameters vary in concert in the modern and past ocean (and thus have joint influence), and the extent to which they may be uncoupled by anthropogenic CO<sub>2</sub> inputs, merits considerable attention. Thus, the integration of pH and oxygen in proxy development would be an important advance.

The focus of this project is on proxy development to determine pH exposure history for living organisms in their larval state, and will center on calcium, boron, and uranium isotopes as well as multi-elemental fingerprints. For this project, the investigators will target open coast, front bay and backbay mytilid mussel species, each living naturally under a different pH regime, and statoliths of encapsulated market squid larvae from the open shelf. Larvae with known pH, oxygen and temperature exposure histories will be obtained from (1) laboratory larval rearing experiments that manipulate pH and oxygen and (2) in situ out planting of lab-spawned larvae in larval homes onto existing moorings where pH, T and oxygen are being monitored. Analyses will employ SIMS (for del 11B), multicollector (for del 44Ca, del 238 U), and laser ablation ICP-MS (targeting B, Cu, U, Pb, Mo, and a suite of additional pH- and redox-sensitive trace elements). Multivariate statistical tools will define ability to detect pH-induced signatures and to determine species or taxon-specific vital effects. The investigators are exploring proxies for invertebrate larvae that are untested in the context of acidification geochemistry. Targeting larvae is critical as many marine organisms produce larval carbonate structures and these stages may be most affected by ocean acidification. The retention of larval shell and statoliths after recruitment may ultimately allow us to test the importance of larval pH and O<sub>2</sub> exposure to survival and population persistence. An ability to assess past exposures through geochemical proxies will provide information about relative pH tolerances and ecosystem-level change in response to changes in the ocean's carbonate chemistry.

**NOTE:** A series of laboratory experiments were run in which *Mytilus* spp. larvae (*Mytilus californianus* and *Mytilus galloprovincialis*) and *Doryteuthis opalescens* (market squid) embryos were reared under controlled temperature, pH and oxygen conditions. Experimental conditions are given in [Table 1](#) (for mussel larvae) and [Table 2](#) (for squid embryos). Geochemistry data in the form of Metal:Ca ratios for mussels has been uploaded to BCO-DMO as "Mussel shell trace element ratios" and squid statolith geochemistry data are available on request.

## Program Information

### Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

**Website:** [https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=503477](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503477)

**Coverage:** global

NSF Climate Research Investment (CRI) activities that were initiated in 2010 are now included under Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES). SEES is a portfolio of activities that highlights NSF's unique role in helping society address the challenge(s) of achieving sustainability. Detailed information about the SEES program is available from NSF ([https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=504707](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707)).

In recognition of the need for basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future, the goal of the SEES: OA program is to understand (a) the chemistry and physical chemistry of ocean acidification; (b) how ocean acidification interacts with processes at the organismal level; and (c) how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean.

#### Solicitations issued under this program:

[NSF 10-530](#), FY 2010-FY2011

[NSF 12-500](#), FY 2012

[NSF 12-600](#), FY 2013

[NSF 13-586](#), FY 2014

NSF 13-586 was the final solicitation that will be released for this program.

#### PI Meetings:

[1st U.S. Ocean Acidification PI Meeting](#) (March 22-24, 2011, Woods Hole, MA)

[2nd U.S. Ocean Acidification PI Meeting](#) (Sept. 18-20, 2013, Washington, DC)

3rd U.S. Ocean Acidification PI Meeting (June 9-11, 2015, Woods Hole, MA - Tentative)

#### NSF media releases for the Ocean Acidification Program:

[Press Release 10-186 NSF Awards Grants to Study Effects of Ocean Acidification](#)

[Discovery Blue Mussels "Hang On" Along Rocky Shores: For How Long?](#)

[Discovery nsf.gov - National Science Foundation \(NSF\) Discoveries - Trouble in Paradise: Ocean Acidification This Way Comes - US National Science Foundation \(NSF\)](#)

[Press Release 12-179 nsf.gov - National Science Foundation \(NSF\) News - Ocean Acidification: Finding New Answers Through National Science Foundation Research Grants - US National Science Foundation \(NSF\)](#)

[Press Release 13-102 World Oceans Month Brings Mixed News for Oysters](#)

[Press Release 13-108 nsf.gov - National Science Foundation \(NSF\) News - Natural Underwater Springs Show How Coral Reefs Respond to Ocean Acidification - US National Science Foundation \(NSF\)](#)

[Press Release 13-148 Ocean acidification: Making new discoveries through National Science Foundation research grants](#)

[Press Release 13-148 - Video nsf.gov - News - Video - NSF Ocean Sciences Division Director David Conover answers questions about ocean acidification. - US National Science Foundation \(NSF\)](#)

[Press Release 14-010 nsf.gov - National Science Foundation \(NSF\) News - Palau's coral reefs surprisingly resistant to ocean acidification - US National Science Foundation \(NSF\)](#)

[Press Release 14-116 nsf.gov - National Science Foundation \(NSF\) News - Ocean Acidification: NSF awards \\$11.4 million in new grants to study effects on marine ecosystems - US National Science Foundation \(NSF\)](#)

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## Funding

| Funding Source   | Award                       |
|--|-----------------------------|
| <a href="#">NSF Division of Ocean Sciences (NSF OCE)</a> | <a href="#">OCE-1401349</a> |

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