

# Elemental ratios in Western Pacific sclerosponges

**Website:** <https://www.bco-dmo.org/dataset/821982>

**Data Type:** Other Field Results

**Version:** 1

**Version Date:** 2020-08-26

## Project

» [Stable Isotopes and Strontium in Western Pacific Sclerosponges: Calibration and Applications to Paleooceanography](#) (Sclerosponges)

Contributors	Affiliation	Role
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## Abstract

Elemental ratios in Western Pacific sclerosponges

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## Coverage

**Spatial Extent:** N:15.033 E:145.1 S:7.267 W:134.517

**Temporal Extent:** 2001-07 - 2003-07

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## Dataset Description

A complete description of the collection and experimental methods is available in Grottoli et al. (2010). In brief, six *A. wellsi* sclerosponges were identified between 11.5 and 18 m depths along the wall at Short Drop Off, Palau. The specimens were stained with Alizarin Red on 26 July 2001, re-cemented onto the reef at a common depth of 11 m depth using Splash Zone marine epoxy, and allowed to grow out past the stain line for 2 years. In Saipan, three *A. wellsi* identified at 6 m depth and four *A. willeyana* sclerosponges identified between 7 and 9 m depth were stained with Alizarin Red on 15 July 2001, re-cemented onto the reef at a common depth of 8.3 m depth with marine epoxy, and allowed to grow out past the stain line for 2 years. On 15 July 2003 and 11 July 2003 all of the specimens were collected from Palau and Saipan, respectively, and were returned to the lab for further analysis.

## Methods & Sampling

In the laboratory, each specimen was cut down its major growth axis, cleaned with deionized water, and dried at 60°C for 3 days. The sclerosponge skeletons were then sampled in two ways for elemental analysis. First, bulk measurements spanning the entire two-year common time period established by the stain lines were obtained from each specimen. Each bulk skeletal sample was milled from the growing edge to the stain line using a Dremmel tool fitted with a diamond-tipped dental drill bit. Second, high-resolution samples were milled at 0.5 mm increments using a Merchantek Micromill from two *A. wellsi* specimens from Palau, one *A.*

wellsi specimens from Saipan, and one *A. willeyana* specimen from Saipan from the growing edge to the stain line.

**Sample Solutions and Standards:** All solutions were made with MilliQ water (18 M $\Omega$ ; Millipore, MA) and ultrapure reagents unless otherwise noted. All labware was pre-cleaned with 5% v/v HNO<sub>3</sub>, 20% v/v HCl and MilliQ water for a minimum of 10 hours each prior to sample handling in a Laminar Flow Exhausting Hood. Gravimetric standards were used to make calibration curves for P, Pb, Ba, and Ca. Stock standard solutions (CPI International) were diluted with ultrapure 2% v/v HNO<sub>3</sub> to concentrations that matched expected range of sample concentrations.

**Sample Preparation:** Bulk sclerosponge samples of approximately 10 mg were pre-cleaned for elemental analysis following methods described in Matthews et al. (2006). In brief, samples were ultrasonicated in MilliQ water, oxidized in a solution of 50:50 0.2M NaOH and 30% H<sub>2</sub>O<sub>2</sub>, reduced using hydrazine buffered in 50:50 mixture of 30% NH<sub>4</sub>OH and 0.25M (NH<sub>4</sub>)<sub>2</sub>C<sub>6</sub>H<sub>6</sub>O<sub>7</sub>, and leached in 0.001M HNO<sub>3</sub>, with sub-boiling heat baths and ultrasonication, and multiple MilliQ water rinses between each step. Following cleaning, samples were dissolved in 6 mL of 2% v/v HNO<sub>3</sub>. High-resolution 0.5 mg samples were prepared in the same method with the exception that they were dissolved into 2.5 mL of 2% v/v HNO<sub>3</sub>.

**Elemental Analyses:** Measurements were carried out on a Thermo Finnigan Element 2 ICP-SFMS using low (m/ $\Delta$ m = 300) resolution (with the exception of P at medium (m/ $\Delta$ m = 4000) resolution) and operated in E-scan mode with an uptake rate of 100  $\mu$ L/min. Internal standards of Co (for Ca and P), Rh (for Ba), and Bi (for Pb) were used to correct for signal drift over the course of the run, blank corrected, and then concentrations calculated using the calibration curves from the gravimetric standards. For quantification, <sup>43</sup>Ca, <sup>31</sup>P, <sup>208</sup>Pb, and <sup>138</sup>Ba were used. At least one additional isotope of each element was monitored to check for interferences. P, Pb, and Ba concentrations were standardized to the measured Ca concentrations. The %RSD for P/Ca, Pb/Ca, and Ba/Ca are 3.7%, 7.2%, and 5.5% or better, respectively, based on repeated measurements of a check standard throughout the sequence of sample measurements.

## Data Processing Description

BCO-DMO Processing:

- renamed fields;
- replaced "n/a" with "nd" as missing data value;
- split latitude and longitude into separate columns;
- converted latitude and longitude from degrees and minutes to decimal degrees (rounded to 3 decimal places);
- replaced commas with semi-colons in Location\_country column.

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## Data Files

File
<b>elemental_ratios.csv</b> (Comma Separated Values (.csv), 5.20 KB) MD5:a89bd78cfaa0ed90106b6f343805a727
Primary data file for dataset ID 821982

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## Related Publications

Grottoli, A. G., Adkins, J. F., Panero, W. R., Reaman, D. M., & Moots, K. (2010). Growth rates, stable oxygen isotopes ( $\delta^{18}O$ ), and strontium (Sr/Ca) composition in two species of Pacific sclerosponges (*Acanthocheatetes wellsii* and *Astrosclema willeyana*) with  $\delta^{18}O$  calibration and application to paleoceanography. *Journal of Geophysical Research*, 115(C6). doi:10.1029/2009jc005586 <https://doi.org/10.1029/2009JC005586>  
*Methods*

Grottoli, A. G., Chapron, L., Gava, D., & Olesik, J. W. (2020). Natural Variability of Skeletal Elemental Phosphorus (P/Ca), Lead (Pb/Ca), and Barium (Ba/Ca) in the Western Pacific Sclerosponges *Acanthocheatetes wellsii* and

Results

Wu, H. C., & Grottoli, A. G. (2009). Stable oxygen isotope records of corals and a sclerosponge in the Western Pacific warm pool. Coral Reefs, 29(2), 413-418. doi:[10.1007/s00338-009-0576-7](https://doi.org/10.1007/s00338-009-0576-7)

General

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## Parameters

Parameter	Description	Units
Location_country	Location name	unitless
Site_Name	Site name	unitless
Lat	Latitude	decimal degrees North
Lon	Longitude	decimal degrees East
Species	Specie name	unitless
Specimen_ID	Specimen identifier	unitless
Sample_ID	Sample identifier	unitless
Measurement_type	Type of measurement (bulk or high resolution)	unitless
Chronology_date	Chronology date; format: years and fraction of year (i.e., 30 January 2001 would be 2001.0822). Samples with dates of "nd" represent material that is integrated over the time period of 26 July 2001 - 15 July 2003 for samples from Palau and 15 July 2001-11 July 2003 for samples from Saipan.	unitless
P_Ca	P/Ca	micromoles per mole (umol/mol)
Pb_Ca	Pb/Ca	micromoles per mole (umol/mol)
Ba_Ca	Ba/Ca	micromoles per mole (umol/mol)

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## Instruments

<b>Dataset-specific Instrument Name</b>	Thermo Finnigan Element 2 ICP-SFMS
<b>Generic Instrument Name</b>	Inductively Coupled Plasma Mass Spectrometer
<b>Dataset-specific Description</b>	Thermo Finnigan Element 2 Inductively Coupled Plasma-Sector Field Mass Spectrometer
<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.

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## Project Information

### Stable Isotopes and Strontium in Western Pacific Sclerosponges: Calibration and Applications to Paleoceanography (Sclerosponges)

#### *NSF Award Abstract:*

Proxy records are extremely useful for reconstructing paleoceanographic/ paleoclimate conditions and hence understanding oceanographic and climate change, although these data must be well-calibrated. However, proxy tools to evaluate annual-to-centennial timescale variability of the stable isotopic composition of dissolved inorganic carbon and oxygen in seawater over the past several centuries in the Pacific or to evaluate these variables and seawater temperature across depth have not been fully developed. The western Pacific plays a large role in tropical and global climate and is therefore an ideal location to pursue this research.

A scientist at the University of Pennsylvania will quantitatively calibrate the sclerosponge, *Acanthocheatetes wellsii*, skeletal  $\delta^{13}\text{C}$ ,  $\delta^{18}\text{O}$ , and strontium/calcium (Sr/Ca) to evaluate calibrated proxy records on annual-to-interdecadal timescales. The calibrations will then be applied to two high-resolution 50-year stable isotope and Sr/Ca records and the interannual-to-interdecadal timescale variability in the longer records will be evaluated by comparing them to available instrumental, satellite, and model output data.

The results will be a valuable tool for constraining existing carbon uptake models, initializing and testing ENSO models, and generally increasing our knowledge of the natural spatial and temporal variability in  $\delta^{13}\text{C}_{\text{DIC}}$ ,  $\delta^{18}\text{O}_{\text{sw}}$ , and seawater temperature at the surface and across depth in the tropics.

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-0610487</a>

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