Exploring Periostracum as a Potential Environmental Proxy in *Arctica islandica*

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A. islandica shells are being considered as a proxy for changes in food web and ecosystem dynamics. A. islandica is considered a good proxy because of its long life span and because it forms annual increments.

To explore this further, we are looking at the isotopic values of carbon and nitrogen along the axis of maximum growth and along the isochron.

The long term goal is to create a time series with older shells and current living shells.
Hypotheses

1. The periostracum will reflect the ambient conditions during the lifetime of *A. islandica* shells. Sampling periostracum material along the maximum growth axis will test this hypothesis. If the stable carbon and nitrogen isotopic data along this transect are homogenous it would falsify the hypothesis.

2. Because each isochron represents an identical time in the shell’s life, the values along the isochron should be similar. If the isotopic values along an isochron are more variable than the instrumental error, this would falsify this hypothesis.

3. *A. islandica* shells can be used to infer food web and ecosystem dynamics. In order to test this hypothesis, hypothesis 1 and 2 must not be falsified. If a comparison between periostracum isotopic values with food isotopic values (such as phytoplankton) representing the same time interval does not yield a consistent relationship, this would falsify this hypothesis.
Methods

1. A 1 mg of periostracum was taken from either side of piece of tape along the axis of maximum growth at marked intervals.

2. The samples were rinsed twice with HCl and DI water.

3. Samples were ground using a mortal and pester.

4. The samples were then prepared for the Elemental Analyzer.

5. Repeat for each shell.
Data: Along Axis of Maximum Growth

Periostracum A. islandica

Carbon and nitrogen isotopic values in samples taken along the axis of maximum growth of A. islandica. Error bars are shown, but may be smaller than symbol.
Isotopic carbon and nitrogen values in samples taken along the axis of maximum growth of radiocarbon shell of *A. islandica*. Error bars are shown, but may be smaller than symbol.
Isotopic carbon and nitrogen values in samples taken along the axis of maximum growth of radiocarbon shell of *A. islandica*. Error bars are shown, but may be smaller than symbol.
Data: Analysis Axis of Maximum Growth

- The data from the axis of maximum growth shows a change as the clam ages.
- The first radiocarbon shell samples had similar results to the results from the live caught shells.
- The second round of trials did not produce trends similar to the first trial.
Isotopic carbon and nitrogen values in samples taken along the isochron of *A. islandica*. Error bars are shown, but may be smaller than symbol.
Isotopic carbon and nitrogen values in samples taken along the isochron of *A. islandica*. The data taken along an isochron has more variation in its results. Initially this was due to mixing years of periostracum. Error bars are shown, but may be smaller than symbol.
Data Analysis: Isochron

- The second round values showed more linear values with a better percent error range along the center of the clam.
- Closer to the edges, the isochrons become smaller thus the samples include more years.
Conclusion

- The isotopic values of stable carbon and nitrogen determined along the axis of maximum growth varied with the shell growth, indicating that the periostracum may reflect the ambient conditions during the life of *A. islandica*.

- The isotopic composition of carbon and nitrogen in samples taken along an isochron were similar, indicating that this material all grew at the same time.

- None of our hypotheses have been falsified with the current data.
Future Work

- As of the moment, the third hypothesis has not been tested.
- In the future more work will be done on comparing periostracum isotopic values with food isotopic values from the Gulf of Maine.
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