

## Nitrogen isotopes in the shell of the Antarctic scallop *Adamussium colbecki* as a proxy for sea ice cover in Antarctica

David P. GILLIKIN<sup>1\*</sup>, Emma PUHALSKI<sup>1</sup>, Steve CAMARRA<sup>1</sup>, Kelly E. CRONIN<sup>2</sup>, Anouk VERHEYDEN<sup>1</sup>, and Sally E. WALKER<sup>2</sup>

<sup>1</sup> Department of Geosciences, Union College, Schenectady NY 12308, USA

<sup>2</sup> Geology Department, University of Georgia, Athens, GA 309602, USA

\* gillikid@union.edu

**Keywords:** Nitrogen isotopes, Sea Ice, Scallop

*Adamussium colbecki* is a large thin-shelled scallop common in Antarctic waters and is well represented throughout the Holocene. Shell nitrogen isotopes in carbonate bound organic matter ( $\delta^{15}\text{N}_{\text{CBOM}}$ ) have the potential to record sea ice state over time. Recent studies illustrated that  $\delta^{15}\text{N}_{\text{CBOM}}$  values provide a similar proxy as soft tissue  $\delta^{15}\text{N}$  values which in turn are predictably related to food  $\delta^{15}\text{N}$  values (Gillikin et al., 2017, GCA, 200, 55–66, doi: 10.1016/j.gca.2016.12.008). Sea-ice organic N should have higher  $\delta^{15}\text{N}$  values compared to open water organics due to nitrate draw down in the ice (Fripiat et al., 2014, Global Biogeochem. Cycles, 28, 115–130, doi:10.1002/2013GB004729). To test this hypothesis, we analyzed *A. colbecki* shells from Explorers Cove and Bay of Sails, western McMurdo Sound, Antarctica. These sites have different sea ice states: persistent (multiannual) sea ice at Explorers Cove and annual sea ice (that melts out every year) at Bay of Sails. Six adult shells collected live at these sites in 2008 (3 from each site) and two juveniles collected in 2016 from Explorers Cove were serially sampled for  $\delta^{15}\text{N}_{\text{CBOM}}$  values from the growing shell margin to the umbo.  $\delta^{15}\text{N}_{\text{CBOM}}$  values from Explorers Cove with persistent sea ice cover were consistently higher ( $+10 \pm 0.7 \text{ ‰}$ ) than those from Bay of Sails where the sea ice melts out every year ( $+8 \pm 0.5 \text{ ‰}$ ; t-test  $p < 0.0001$ ).  $\delta^{15}\text{N}_{\text{CBOM}}$  data from Mid- to Late Holocene shells that grew in these locations showed a similar pattern, but shells from Bay of Sails were not as low as modern shells suggesting sea ice state has changed at this site over the past 1000 years. We posit that nitrogen isotopes in *A. colbecki* shells have a high potential to record sea ice cover.