

Holocene paleoclimate of McMurdo Sound, Antarctica reconstructed from growth striations and $\delta^{13}\text{C}$, $\delta^{18}\text{O}$, and $\delta^{15}\text{N}$ values in shells of the Antarctic scallop *Adamussium colbecki*.

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Fluctuations in sea ice cover are major factors driving climate change and are a substantial component of the global climate feedback loop. Antarctica currently lacks notable proxy records of sea ice state; bivalves archive environmental conditions and can be studied to track changes in sea ice cover through time. *Adamussium colbecki* is a large sea scallop with a circum-Antarctic distribution with an abundant fossil record throughout the Holocene. Our group's prior work showed that carbon ($\delta^{13}\text{C}_s$) and nitrogen ($\delta^{15}\text{N}_{\text{CBOM}}$) isotopes in modern scallop shells record seasonal variation in sea ice state over time when paired with growth markers called striae. We also found that sea ice cover is recorded by low $\delta^{13}\text{C}_s$ values in narrow striae while ice-free conditions are recorded by high $\delta^{13}\text{C}_s$ values in wide striae. Nitrogen isotopes of carbonate bound organic material also recorded sea ice state, with lower values recorded below ice-free conditions. Here we apply these paleoclimate proxies by analyzing *A. colbecki* subfossil shells collected from terraces along Explorers Cove (EC) and Bay of Sails (BOS), western McMurdo Sound, Antarctica which grew between 1,000 and 6,000 years ago (based on ^{14}C ages). Today, these two sites have contrasting sea ice states: persistent (multiannual) sea ice at EC and annual sea ice (that melts out every year) at BOS. Two adult fossil shells collected at EC and four fossil shells (including one juvenile) collected at BOS were serially sampled for $\delta^{13}\text{C}$, $\delta^{18}\text{O}$, and $\delta^{15}\text{N}$ from the growing shell margin to the umbo. Imaging of striae allowed for $\delta^{13}\text{C}_s$ and $\delta^{18}\text{O}_s$ values to be paired with summer (wide striae) and winter (narrow striae) scallop growth; $\delta^{15}\text{N}_{\text{CBOM}}$ required larger sample size, so were not seasonally paired. Seawater temperature proxy records suggest warmer conditions 2,000-5,000 ybp, so we expect variable $\delta^{13}\text{C}_s$ values recording annual sea ice in shells from both sites.

Fossil BOS and EC $\delta^{13}\text{C}_s$ means are not statistically different between wide and narrow striae groups, indicating multiannual sea ice may have been present at both sites 1,000-6,000 years ago. Fossil $\delta^{18}\text{O}_s$ means are statistically higher than modern $\delta^{18}\text{O}_s$ values at both BOS and EC, which would indicate similar conditions at both sites while the scallops were alive. The 0.24‰ difference (t-test $p < 0.0001$) may mean water temperatures were ~1°C colder, there was decreased meltwater input, or a combination of these factors are represented in the fossil shells. However, these colder temperatures are not consistent with estimated warmer temperatures 2-6,000 years ago (Braddock et al., 2014) and may imply intervals of cold and warm conditions. The wide spread of fossil BOS $\delta^{13}\text{C}_s$ values may be a time averaged result of multiple sea ice conditions at BOS. $\delta^{15}\text{N}_{\text{CBOM}}$ data are forthcoming. Serial sampling of modern and fossil shells of *A. colbecki* allow comparisons of wide (summer) and narrow (winter) striae with stable carbon

and oxygen isotopes to provide high resolution proxies for sea ice persistence and temperature to understand Antarctica's sea ice history.