PP43E-1706 Understanding the Boron Isotope and pH Relationship in Four Species of Commercially Important Marine Bivalves

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Abstract:

The boron isotopic composition ($\delta^{11}B$) of marine carbonates is well-established as a proxy for reconstructing past seawater pH. However, the modification of seawater carbonate chemistry at the site of calcification in biocalcifiers remains unclear and is important to understand given predicted future ocean acidification (OA) conditions. To address this, a 21-week tank experiment was conducted in 2022 at Bowdoin College (Brunswick, Maine, USA) in which four species of commercially important bivalves from the northwest Atlantic Ocean were grown in tanks with controlled pH (ambient/~8.0, 7.8, 7.6 or 7.4) and temperature conditions (6, 9 or 12 °C). Over 100 shell samples from adult and juvenile *Arctica islandica* (ocean quahog), *mercenaria mercenaria* (northern quahog), *mya arenaria* (soft-shell clam) and *Placopecten magellanicus* (Atlantic sea scallops) have been analyzed for $\delta^{11}B_c$ (carbonate boron isotope) with the goal of assessing the $\delta^{11}B_c$-pH relationship.

It is unlikely that a robust $\delta^{11}B_c$-pH relationship exists for these mollusks. Overall, the results suggest that low values of pH are associated with lower $\delta^{11}B_c$, however, the strength of this relationship is weaker than required for the development of a robust boron isotope-pH proxy. Different slopes for this relationship for each species indicate a strong biological control on $\delta^{11}B_c$.

Furthermore, all four of the species have $\delta^{11}B_c$ values that indicate that their internal extrapallial fluid (EPF) pH is lower than the pH of the seawater from which they precipitated their shells, an opposite relationship of other calcifiers (i.e. stylasterid corals) but consistent with other studies which support the idea that many calcium carbonate species have the ability to regulate pH in their EPF. This ability to modulate calcifying fluids, especially in low pH environments, may be beneficial to these organisms in predicted future OA conditions. Suggested mechanisms behind these results include an increase in calcium and/or dissolved inorganic carbon within the EPF allowing calcification to occur even when seawater is undersaturated with respect to aragonite. An assessment of various mechanisms to explain the low pH of the EPF will continue to be investigated and is a critical step in our understanding of how these species will respond to future OA conditions.