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Toward a mechanistic understanding of δ^{13}C in the aragonitic bivalve shells of *Mercenaria mercenaria*

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The stable carbon isotopic signature recorded in bivalve shells was originally thought to record the δ^{13}C of seawater dissolved inorganic carbon (DIC) [1]. However, more recent studies have shown that the incorporation of isotopically light metabolic carbon significantly affects the δ^{13}C signal recorded in biogenic carbonates [2, 3, 4]. Furthermore, a study on *Pecten maximus* revealed that the ontogenic decrease of δ^{13}C values in bivalve shells is probably a reflection of increased metabolism in larger bivalves relative to their growth rate, leading to a larger availability of metabolic C for $CaCO_3$ precipitation [4]. To test if indeed this is the case, we sampled tissue, hemolymph (i.e., bivalve blood) and shell δ^{13}C from *Mercenaria mercenaria* collected in North Carolina, USA.

We found up to a 4‰ decrease in shell δ^{13}C in a 23 year old individual (shell length = 92 mm). There was no correlation between shell length or age and gill, muscle or mantle δ^{13}C, while there was a significant positive relationship between foot δ^{13}C and shell length ($p<0.01$, n=13; $\sim$1‰ over 87 mm length). However, a decrease in shell δ^{13}C caused by changing food sources leading to more negative metabolic CO_2 δ^{13}C would require a negative relationship between tissue δ^{13}C and length, contrary to what we found. Hemolymph δ^{13}C, on the other hand, did exhibit a negative relationship with length ($p<0.01$, n=5). This indicates that hemolymph in young specimens reflects seawater DIC δ^{13}C and as the clams grow, more negative metabolic CO_2 is added, resulting in a lowering of the hemolymph δ^{13}C and subsequently shell δ^{13}C. This study confirms the hypothesis of Lorrain et al. [4] for *M. mercenaria*.

[1] Mook & Vogel 1968 Science 159:874-5; [2] Tanaka et al 1969 Nature 320:520-23; [3] McConnaughey et al 1997 GCA 61:611-22; [4] Lorrain et al 2004 GCA 68:3509-19.