d13C of fluvial mollusk shells (Rhône River): A proxy for dissolved inorganic carbon?

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ABSTRACT: The relationship between the δ¹³C of dissolved inorganic carbon (DIC) and modern mollusk aragonite from rivers was calibrated for the purpose of reconstructing DIC paleochemistry from the shell record. The δ¹³C values of aragonitic bivalves (*Dreissena polymorpha*, *Corbicula fluminea*), prosobranch gastropods (*Bithynia tentaculata*, *Theodoxus fluviatilis*, *Viviparus viviparus*), and an air-breathing pulmonate gastropod (*Limnea auricularia*) were analyzed from several locations on the Rhône River (-13.7‰ to -6.0‰) and its major tributary, the Saône River (-11.4‰ to -10.2‰). The $\delta^{13}C_{DIC}$ varied from -11.5‰ to -7.5‰, and the δ¹³C of particulate inorganic matter (POM) varied from -31.7‰ to -25.4‰. At a given site, the δ¹³C of all species except the pulmonate were within 1‰ of each other. Whole-shell δ¹³C correlated positively with $\delta^{13}C_{DIC}$, with a slope close to unity. Bioaragonite-DIC fractionations were 0-1.5‰ for bivalves and 0-2.7‰ for gastropods (excluding the pulmonates). Applying these fractionations, bivalves that live in open water are a reliable proxy, monitoring the average $\delta^{13}C_{DIC}$ value to within its natural ~2‰ temporal variation within the growth period. For the suspension feeders (bivalves) using POM as a food source, the δ¹³C of whole shells and bulk POM indicated that the incorporation of carbon derived from respiratory sources lay in the range 10-30%. Fine-scale analyses of growth increments of C. fluminea could not be related simply to $\delta^{13}C_{DIC}$ because metabolic and seasonal variations in $\delta^{13}C_{DIC}$ produced similar isotopic fluctuations (≤2.5‰).