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

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ABSTRACT: The relationship between the δ^{13} C 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 δ^{13} C 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 δ'³C_{oc} varied from -11.5‰ to -7.5‰, and the δ'³C of particulate inorganic matter (POM) varied from -31.7‰ to -25.4‰. At a given site, the δ'³C of all species except the pulmonate were within 1‰ of each other. Whole-shell δ'³C correlated positively with δ'³C_{or}, 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 $\delta^{\prime\,3}C_{\rm oc}$ value to within its natural ~25% temporal variation within the growth period. For the suspension feeders (bivalves) using POM as a food source, the $\delta^{\text{-a}}$ C 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 $\delta^{ij}C_{op}$ because metabolic and seasonal variations in $\delta^{ij}C_{op}$ produced similar isotopic fluctuations (≤2.5‰).

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