

## **In situ measurements of isotopic and elemental ratios in brachiopods: Implications for their use as environmental proxies and their biomineralization processes**

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Brachiopods are often used as archives to reconstruct past environmental conditions. However, vital effects linked to their biomineralization processes can impact the record of geochemical proxies. To study these potential effects, we measured oxygen isotopic composition ( $\delta^{18}\text{O}$ ) and minor and trace elements (MTE - Li, Na, Mg and Sr) by using in situ techniques, i.e. ion microprobe and laser ablation coupled to an ICP-MS. These in situ techniques allow to focus on the different microstructure layers of the brachiopod shells: the primary acicular or microgranular layer (PL), the secondary fibrous layer (SL) and for some species, the tertiary columnar layer (TL). Analyses were performed on seven modern brachiopod species from different environments (Temperature, Salinity and pH). All measurements showed that the PL is depleted in  $^{18}\text{O}$  and enriched in MTE compared to inorganic calcite in equilibrium with seawater. The SL generally shows a trend from the PL values towards reaching a plateau in the innermost part of the SL. This plateau is close to or equivalent to inorganic calcite in equilibrium. Finally, the TL is depleted in all the MTE and in oxygen isotopic equilibrium. These geochemical features are best explained by kinetic effects in the SL; PL could be the result of precipitation via amorphous precursors; and TL could reflect different ionic transport of MTE compared to PL and SL. For the use of brachiopods as environmental archives, the TL appears the most suitable, but as it is not present in all the brachiopod species, the innermost SL could be an alternative.