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Variations in the boron isotopic and elemental composition in modern brachiopods: Assessing the biomineralization processes in the shell microstructure.

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The boron isotope composition (commonly expressed as δ11B) of marine calcium carbonate is one of the most reliable pH proxies (e.g. Vengosh et al., 1991; Hemming and Hanson, 1992). In this context, brachiopods are a potential archive due to their great abundance in the geological record and their low-magnesium calcite shells that make them more resistant to diagenetic alteration (e.g. Lowenstam, 1961; Veizer et al., 1986). This study focuses on the impact of brachiopod shell biomineralization processes on the boron isotopic and elemental (B/Ca) compositions. Boron isotope analyses were performed at the micrometer scale by ion microprobe, and by laser ablation (LA) coupled to a MC-ICP-MS to create 2D images, while B/Ca was determined using LA-ICP-MS in shells of five modern brachiopods species composed of primary (PL) and secondary layer (SL) (Terebratalia transversa, Magasella sanguinea, Notosaria nigricans, Calloria inconspicua and Magellania venosa) and one species composed also with tertiary layer (TL) (Liothyrella neozelanica). Our results show that the PL is slightly depleted in 11B relative to the SL and higher in B/Ca. The SL layer does not show a specific trend of δ11B from the outermost to the innermost shell thickness. B/Ca ratio goes towards lower values in the innermost regions of the shell likely due to kinetic effects, as less boron is incorporated as growth rates slow. Values obtained here are similar to those previously published (Lécuyer et al., 2002; Penman et al., 2013). Regarding the TL, B/Ca values are lower than in PL and SL. We will further explore the mechanisms responsible for such differences in δ11B and B/Ca values between the different shell layers and its potential use as palaeo-pH proxy.

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