Intra-shell variability of magnesium isotope compositions in brachiopod shells

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This study presents carbon, oxygen, and magnesium isotope compositions of two modern brachiopods, *Terebratalia transversa* and *Frielia halli*, and one fossil specimen (2.3 Ma), *Terebratula scillae*. The aim of this study is to investigate the intra-shell variability of these isotopic compositions and to evaluate the potential of brachiopod as a proxy of past seawater δ^{26}Mg. The two investigated brachiopod shells present the same range of δ^{26}Mg variation (up to 2 ‰). This variation cannot be ascribed to changes in environmental parameters (like temperature or pH). As it was already observed, the primary layer of calcite shows the larger oxygen and carbon isotope disequilibrium relative to seawater. In contrast, the primary layer δ^{26}Mg value corresponds to isotopic equilibrium between calcite and water, contrary to oxygen and carbon isotope compositions. This observation could be due to different mechanisms or pathways of calcification between the primary and the secondary calcite layers of the studied brachiopods. δ^{26}Mg is negatively correlated to oxygen and carbon isotopic compositions, in *T. scillae* and there is a negative trend in *T. transversa*. These trends can be explained by kinetic effects linked to changes in growth rate during the brachiopod life. The innermost calcite layer of *T. transversa* is in isotopic equilibrium for both oxygen and magnesium, δ^{13}C values resulting from addition of metabolic CO_2 during respiration. This shell layer seems therefore the best target for reconstructing past δ^{26}Mg of seawater.