The quest for evaluating Mg/Ca in bivalve shells as a temperature proxy: Where are we now?

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The stable oxygen isotope ratios ($\delta^{18}O$) is a widely used temperature proxy in carbonates, though it necessitates an estimation of the seawater $\delta^{18}O$. This last parameter covariates with salinity which is most of the time hardly constrained in ancient times. The search for new solely-thermodependant proxies has been conducted for decades. Mg/Ca ratios in calcitic bivalve shells has been presented as a suitable successor of $\delta^{18}O$ but seems to present compositional shifts not related to temperature fluctuations and thought to be induced by metabolic activity ("vital effects").

Over the last decades, multiple breeding experiments have been conducted in different coastal settings to study Mg/Ca fluctuations in mussel and oyster shells compared to *in situ* temperature measurements. Results present some heterogeneity in thermodependance of Mg/Ca, with correlation factors ranging from 0.3 [1] to 0.9 [2]. A part of this heterogeneity can be explained by high-frequency fluctuations related to the moon cycle (tides) and a difference in metabolic regimes during spring (rising temperatures) and autumn (falling temperatures) [3], restricting the use of this proxy to seasonal thermal contrasts.

Though specimens from a single locality present the same range in Mg/Ca values, specimens from the same bivalve species exhibit a wide dissimilarity in Mg incorporation when bred in different locations (up to one order of magnitude) [1-3]. This may be due to the availability of Mg in seawater on each locality.

[1] Surge & Lohmann (2008) *J. Geophys Res. Biogeosci* **113**, G02001. [2] Vander Putten *et al.* (2000) *Geochim Cosmochim Acta* **64** 997-1011. [3] Mouchi *et al.* (2013) *Palaeogeogr. Palaeoclimatol. Palaeoecol.* **373** 66-74.