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δ^{26}Mg record of Phanerozoic oceans

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The secular variation in the marine Mg/Ca ratio over geologic time is undisputed, however, the role of driving forces behind this phenomenon remains uncertain. A key to the discrimination of major fluxes is the quantification of the Mg oceanic cycle that in turn can be examined by using the Mg isotope compositions of low-Mg calcite brachiopod shells. Within the BASE-LiNE Earth project, a total of 95 analyses on modern and fossil (early Ordovician to Quaternary) brachiopod specimens were performed to generate an inferred δ^{26}Mg paleo-seawater record. As a prerequisite, selected modern, globally distributed species, whose average “habitat temperatures” range from about 0 to 29°C, were investigated and results revealed a weak (~0.02‰°C^{-1}) temperature-sensitivity of δ^{26}Mg in shells. This supports their suitability for paleo-seawater δ^{26}Mg reconstructions. The offset Δ^{26}Mg between modern global seawater δ^{26}Mg [1] and the average of modern brachiopods is about –1.26 ‰, and has been applied to fossil samples. A preliminary locally weighted and smoothed δ^{26}Mg paleo-seawater trend yielded (i) short-term negative and positive anomalies during the Cenozoic, (ii) rather constant values during most of the Mesozoic, (iii) a significant positive-to-negative shift during the Permian/Carboniferous transition, and (iv) systematically negative values during the rest of the Palaeozoic (relative to modern seawater). This composite δ^{26}Mg record of Phanerozoic seawater will be simulated via a coupled numerical model of oceanic elemental cycles [2], and conclusions will be made regarding the plausible driving mechanism(s) behind the observed long-term changes in the marine Mg/Ca record.

[1] Ling et al. (2011) *Rapid Commun. Mass Spectrom.* **25** 2828–2836. [2] K. Wallmann (2001), *Geochim. Cosmochim. Acta* **65**, 3005–3025.