Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.27882

# Evolution of the oceanic Mg cycle through time: Insights from $\delta^{26}Mg$ record of marine carbonate (brachiopods) and authigenic clay (glauconite) archives

**JURAJ FARKAS**[1], KLAUS WALLMANN[2], XIN-YUAN ZHENG[3], DR. STEFAN LÖHR[4], ZHUFU SHAO[1], JAN SRODON[5] AND UWE BRAND[6]

[1]University of Adelaide
[2]GEOMAR Helmholtz Centre for Ocean Research Kiel
[3]University of Minnesota - Twin Cities
[4]Metal Isotope Group (MIG), Earth Sciences, University of Adelaide
[5]Institute of Geological Sciences, Polish Academy of Sciences
[6]Brock University

This contribution presents a compilation of magnesium (Mg) isotope variations ($\delta^{26}Mg$ proxy data) measured in modern and ancient marine archives, including (i) biogenic skeletal carbonates (calcitic brachiopod shells), and (ii) marine authigenic clays (glauconite pellets), covering the Phanerozoic Eon (last ~540 Ma) and the Ediacaran/Cambrian transition (~580 to 540 Ma). The representative Mg isotope fractionation factors ($\Delta^{26}Mg$) between present-day seawater and the above archives/minerals have been determined in modern settings, yielding $\Delta^{26}Mg$ values or offsets of ~1.2‰ and ~0‰ for calcitic shells and glauconite pellets, respectively. The acquired $\Delta^{26}Mg$ offsets are applied to the measured $\delta^{26}Mg$ (DSM3) values from ancient brachiopods and glauconites to infer the plausible Mg isotope composition of paleo-seawater through time. Briefly, both marine archives or proxy records suggest a gradual but rather limited (<0.5‰) increase in the $\delta^{26}Mg$ of paleo-seawater with time (from the present to the Cenozoic and Mesozoic), which is in general agreement with other recently published marine $\delta^{26}Mg$ records from dolomites and/or halite-fluid inclusions [1]. In contrast, our reconstructed $\delta^{26}Mg$ trend(s) for the Paleozoic seawater differs - based on the archives used - where the brachiopod-based $\delta^{26}Mg$ record suggests a similar-to-modern or isotopically lighter paleo-seawater (relative to present-day oceans), while the best-preserved glauconite based $\delta^{26}Mg$ data indicate isotopically heavier Paleozoic (and Ediacaran) oceans compared to recent. The generated marine $\delta^{26}Mg$ trends (brachiopod vs. glauconite data) will be interpreted and modelled in terms of (i) possible diagenetic effects, and (ii) long-term changes in the oceanic Mg cycle through time [2], with implications for key drivers of the Phanerozoic seawater chemistry and marine Mg/Ca ratios, namely, the carbonate (dolomitization) vs silicate (hydrothermal, reverse weathering) oceanic Mg output fluxes.

**References**

[1] Xia Z. et al. (2024) *The evolution of Earth's surficial Mg cycle over the past 2 billion years.* Science Advances, Vol. 10, p. 1-10. DOI: 10.1126/sciadv.adj5474

[2] Farkas J. et al. (2025) *Alkalinity and elemental cycles in present and past ocean: Insight from geochemical modelling and alkali and alkaline earth metal isotopes,* Treatise on Geochemistry, Third Edition, Vol. 5. p. 33-87. doi.org/10.1016/B978-0-323-99762-1.00037-1