



Magnesium isotope fractionation during inorganic and cyanobacteria-induced hydrous magnesium carbonate precipitation

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Some of the largest measured Mg isotope variations are found in carbonate rocks, with a $\sim 2\text{‰}$ $\delta^{26}\text{Mg}$ difference between dolostone and limestone suggesting a strong mineralogical control on Mg isotope compositions (e.g. Yong and Galy, 2004). However, to date very little attention has been paid to the potential for Mg isotopic fractionation during bacterially induced carbonate precipitation. To address this we have performed a series of well-constrained dypingite ($\text{Mg}_5(\text{CO}_3)_4(\text{OH})_2 \cdot 5\text{H}_2\text{O}$) precipitation experiments in the presence of *Gloeocapsa* sp cyanobacteria. Experiments were performed at 25°C in batch reactors containing active cyanobacteria with a continuous bubbling of atmospheric air. The Mg isotope composition was determined for both the experimental solutions and the precipitated dypingite, using multi-collector inductive coupled plasma mass spectrometry (MC-ICP-MS) (Pearce *et al.*, 2009).

Our results demonstrate that the presence of active *Gloeocapsa* sp. bacteria significantly modifies the chemical composition of the growth solution (for both Mg^{2+} concentrations and alkalinity). Furthermore, the culture medium becomes progressively enriched in the heavier Mg isotopes (with respect to an inorganic control experiment), implying that bio-dypingite preferentially incorporates the lighter Mg isotopes. These observations provide the first experimental evidence for Mg isotope fractionation during precipitation of hydrous carbonates under earth-surface conditions, and suggest that biological activity may have significantly affected the Mg isotopic composition of carbonates in the geological record.

E.D. Young and A. Galy (2004). The isotope geochemistry and cosmochemistry of magnesium. *Rev. Min. & Geochem.* **v.55**, p.197-230.

C.R. Pearce, G.D. Saldi, J. Schott, K.W. Burton and E.H. Oelkers (2009) Experimental quantification of kinetic Mg-isotope fractionation during magnesite precipitation. *Geochim. Cosmochim. Acta.* **v.73**, p.A1003.