Experimental calibration of Mg isotope fractionation between dolomite and aqueous Mg^{2+} ions

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Dolomite is a common Mg-bearing mineral in carbonate rock. Variations in Mg isotope ratios in dolomite are potentially useful indicators for processes such as diagnesis and dolomitization. Magnesium isotope fractionation factors between dolomite and aqueous solution ($\Delta^{26}Mg_{dolo\text{-}aq}$) have been predicted using *ab initial* caculations in two studies [1,2], but the calculated $\Delta^{26}Mg_{dolo\text{-}aq}$ values do not agree in the two studie, with one predicting positive $\Delta^{26}Mg_{dolo\text{-}aq}$ fractionation [1] and the other predicting negative $\Delta^{26}Mg_{dolo\text{-}aq}$ fractionation [2]. No experimental data have been reported for $\Delta^{26}Mg_{dolo\text{-}aq}$.

Here, we report preliminary results on Mg isotope fractionation between dolomite and aqueous Mg^{2+}. Dolomite was synthesized at hydrothermal conditions by reacting aragonite with a solution that contains 1M $MgCl_2$ and 1M $CaCl_2$. For experiments at 160 °C, aragonite was completely coverted to dolomite after 19 days, although XRD analyses reveal that the crystallinity of the synthesized dolomite continued to increase with reaction time. For experiments at 220 °C, aragonite disappeared and dolomite formed after 17 hours.

The measured $\Delta^{26}Mg_{dolo\text{-}aq}$ fractionation at 160 °C is -0.11±0.12 ‰ for the experiment that lasted for 19 days. For experiments with durations of 26 and 39 days, the $\Delta^{26}Mg_{dolo\text{-}aq}$ fractionation decreased and stablized at around -0.7 ‰. The measured $\Delta^{26}Mg_{dolo\text{-}aq}$ fractionation for experiment at 220 °C is -0.46±0.05 ‰, consistent with the general rule that the magnitude of stable isotope fractionation decreases as temperature increases. The measured $\Delta^{26}Mg_{dolo\text{-}aq}$ fractionations are lower than those predicted by Rustad *et al* [1], but higher than those predicted by Schauble *et al* [2]. Athough more work is needed to access kinetic isotope effects versus equilibrium fractionation, the preliminary results imply that light Mg isotopes preferentially partition into dolomite relative to aqueous Mg^{2+}.

[1] Rustad *et al* (2010) *GCA* **74**, 6301-6323. [2] Schauble (2011) *GCA* **75**, 844-869.