

Experimental determination of the isotope fractionation between aqueous fluid brucite and amorphous silica, and among Mg and Si aqueous species

F. M. STAMM^{1*}, T. ZAMBARDI², J. CHMELEFF¹,
M. MÉHEUT¹, J. SCHOTT¹, AND E.H. OELKERS^{1,3}

¹GET, CNRS/URM 5563, Université Paul Sabatier, 14
avenue Edouard Belin, 31400 Toulouse, France

(*correspondence: franziska.stamm@get.omp.eu)

²LEGOS, OMP, 14 avenue Edouard Belin, 31400 Toulouse,
France

³Earth Sciences, University College London, Gower Street
London WC1E 6BT, UK

Due to their high concentrations in rock-forming minerals and natural fluids, magnesium (Mg) and silicon (Si) play a key role in many processes affecting the Earth's crust, the surface of continents and the oceans. Investigating Mg and Si isotope signatures in solids and fluids can thus provide useful information on these geological processes. Such an approach requires knowing the equilibrium isotope fractionation between Mg- and Si- bearing solid phases and fluids, and among the important Mg and Si aqueous species.

For this purpose we performed isotope exchange experiments at *bulk chemical* equilibrium between aqueous fluids enriched in ²⁵Mg or ²⁹Si of various compositions and pH, and brucite (Mg(OH)₂) or amorphous silica. Experiments were run up to 315 days. The 'three isotope method'^[1] was used to quantify the advancement of the isotope exchange reaction and thus derive the equilibrium fractionation factors between brucite and Mg²⁺(aq), Mg²⁺(aq) and Mg-Citrate⁻, and between H₄SiO₄⁰ and amorphous silica, H₃SiO₄⁻, and the Si-Catecholate and Si-Malonate complexes.

The results of this study are compared with ab initio calculated fractionation factors and discussed in terms of the mechanisms controlling chemical and isotopic exchanges at the solid-solution interface.

[1]: Matsuhisa, Goldsmith & Clayton (1978), *Geochim. Cosmochim. Acta* **42**, 173–182.