

The behaviour of beryllium in mafic systems

A. D. BURNHAM^{1*}, H. STC. O'NEILL¹ AND
M. C. JOLLANDS¹

¹Research School of Earth Sciences, Australian National University, Canberra ACT 2601, Australia

(*correspondence: antony.burnham@anu.edu.au)

The crystal/melt partitioning systematics of beryllium, one of the least abundant elements in the Solar System, are poorly known in basaltic systems. Empirical relationships with other incompatible elements indicates that Be correlates with Nd, a moderately to highly incompatible Rare Earth Element, but quantitative experimental data are scarce.

Here we combine data from two sources to examine the partitioning behaviour of Be in mafic systems. (i) Diffusion experiments of Be into forsterite were performed over the temperature range 1050 – 1500 °C using the buffering assemblage $\text{BeO} + \text{MgO} + \text{Mg}_2\text{SiO}_4$ (low silica activity) and over the temperature range 950 – 1300 °C using the buffering assemblage $\text{BeO} + \text{MgSiO}_3 + \text{Mg}_2\text{SiO}_4$ (high silica activity). In addition to the diffusion information, these experiments provide the saturation solubility of Be in forsterite as a function of temperature and silica activity: Be solubility is higher in the enstatite-buffered samples.

(ii) Forsterite/melt partitioning experiments carried out at 1400 °C in the system $\text{Na}_2\text{O}-\text{CaO}-\text{MgO}-\text{Al}_2\text{O}_3-\text{SiO}_2-\text{TiO}_2$ demonstrate the effect of melt composition and allow activity coefficients to be determined. $D_{\text{Be}}^{\text{forsterite}/\text{melt}}$ is negatively correlated with X_{CaO} (the mole fraction of CaO in the melt), in striking contrast to $D_{\text{Ca}}^{\text{forsterite}/\text{melt}}$ which is positively correlated with X_{CaO} .

Together, these two sources of thermodynamic data allow the partitioning of Be into forsterite to be evaluated as a function of temperature and melt composition.

The Be diffusion data confirm the observation of [1] that diffusion of Be in olivine is more rapid than any other investigated species apart from H and is highly anisotropic.

[1] Spandler & O'Neill (2010), *Contrib. Mineral. Petrol.* 159, 791–818. [2] Dohmen, Kasemann, Coogan & Chakraborty (2010), *Geochim. Cosmochim. Acta* 74, 274–292.