Synthesis of single- and multi-REE carbonates between 40 and 200 °C

M. HOLLOWAY[1]*, B.T. NGWENYA[1], I.B. BUTLER[1], J.F.W. MOSSELMANS[2]

[1]Grant Institute, School of GeoSciences, The University of Edinbugh, James Hutton Road, Edinburgh, EH9 3FE, UK (*correspondence: matthew.holloway@ed.ac.uk)

[2]Diamond Light Source, Harwell Science and Innovations Campus, Didcot, Oxfordshire, OX11 0DE, UK (fred.mosselmans@diamond.ac.uk)

Although carbonates of rare earth elements (REE) are rare, fluorocarbonates are one of the most important source of these elements. Their occurenece is characterised by complex textural relationships with host rock and gangue minerals, often indicative of precipitation from REE-rich fluids reacting with wall rocks [1, 2]. Experimental studies synthesising REE carbonates and fluorocarbonates are valuable in understanding physiochemical controls on crystal morphology and structure [3]. However, studies involving direct reaction of REE-bearing solutions with wall rocks to produce REE carbonates are rare in the literature.

As a starting point for understading the genesis of REE fluorocarbonates through wall rock reactions, we have synthesised single- and multi-REE carbonates (La, Nd, Gd, Er and Yb) by direct mixing of REE- and carbonate-bearing solutions, and also by interaction of REE-bearing solutions with dolomite, at temperatures from 40 to 200 °C.

Direct mixing of solutions produces crystalline carbonates for light REE-bearing solutions (single- and multi-REE systems) at all temperatures, but only at >130 °C for heavy REEs. Interaction of REE-bearing solutions with dolomite is more complex. At <100 °C, all the REEs used (except Yb) produce crystalline carbonates on the dolomite surface. When using multi-REE solutions, good crystallisation is also generally observed at <100 °C, unless Yb is added, suggesting this element inhibits crystal growth at these conditions. At higher temperatures, however, solutions containg up to five REEs (including Yb) produce good crystallisation on dolomite. These results are consistent with a dominant control of temperaure on crystallisation kinetics.

[1] Ngwenya, B.T. (1994), *Geochim. Cosmochim. Acta* **58**, 2061-2072. [2] Gysi, A.P. & Williams-Jones, A.E. (2012), *Geochim. Cosmochim. Acta* **122**, 324-352. [3] Vallina, B., Rodriguez-Blanco, J.D., Balnco, J.A. & Benning, L.G. (2014) *Min. Mag.*, **78**, 1391-1397.