

Experimental characterisation of basalt carbonation by seawater- dissolved CO₂ at 130 °C

MARTIN VOIGT¹, CHIARA MARIENI², ANDRE
BALDERMANN³, IWONA M. GALECZKA⁴, DOMENIK
WOLFF-BOENISCH⁵, ERIC H. OELKERS² AND SIGURDUR
R GISLASON¹

¹Institute of Earth Sciences, University of Iceland

²Géosciences Environnement Toulouse-CNRS

³Graz University of Technology

⁴University of Iceland

⁵Curtin University

Presenting Author: martinvoigt@hi.is

The interaction of marine basalt with percolating seawater in low-temperature ocean floor hydrothermal systems over millions of years leads to calcite and aragonite formation. The presence of these minerals in marine basalts provides evidence for substantial CO₂ fixation in these rocks. Laboratory experiments to quantify this process were performed by reacting mid-ocean-ridge-basalt (MORB) glass with North Atlantic Seawater charged with CO₂ at 130°C in batch experiments lasting up to 5 months. For experiments initiated using seawater charged with ~ 2.5 bar CO₂ partial pressure (*p*CO₂) calcite and aragonite are the first carbonate minerals to form, later succeeded by aragonite (± siderite and ankerite). For experiments started using seawater charged with ~ 16 bar *p*CO₂, magnesite was the only carbonate mineral observed to form. In total approximately 20 % of the initial CO₂ in the reactors were mineralized within five months. This carbonation rate is similar to corresponding rates observed in freshwater-basalt-CO₂ interaction experiments and during field experiments of the carbonation of fresh basalts in response to CO₂-charged freshwater injections in SW-Iceland. Our experiments thus suggest that CO₂-charged seawater injected into submarine basalts will mineralize rapidly. Notably at *p*CO₂ of tens of bars, magnesite will form, preventing the formation of Mg-rich clays, which might otherwise compete for the Mg cation and pore-space in the submarine basaltic crust. This suggests that the injection of CO₂-charged seawater into subsurface basalts can be an efficient and effective approach to the long-term safe mineral storage of anthropogenic carbon.