

## Partitioning of Fe during carbonation of Fe-rich brucite

COLTON VESSEY<sup>1</sup>, SIOBHAN WILSON<sup>1</sup>, MAIJA  
RAUDSEPP<sup>1</sup> AND ANNA HARRISON<sup>2</sup>

<sup>1</sup>University of Alberta

<sup>2</sup>Géosciences Environnement Toulouse (GET) - CNRS

Presenting Author: vessey@ualberta.ca

Carbon capture, utilization, and storage (CCUS) technologies are becoming increasingly important to stabilize atmospheric CO<sub>2</sub> concentrations.<sup>1</sup> One such technology being utilized in alkaline mining systems is mineral carbonation – removal of CO<sub>2</sub> by precipitation of benign calcium (Ca) and magnesium (Mg) carbonate minerals, such as calcite (CaCO<sub>3</sub>) or hydrated magnesium carbonate phases {e.g., hydromagnesite [Mg<sub>5</sub>(CO<sub>3</sub>)<sub>4</sub>(OH)<sub>2</sub>·4H<sub>2</sub>O]}.<sup>2</sup> While carbonation products and rates have been well defined for stoichiometric brucite [Mg(OH)<sub>2</sub>], the presence of incorporated trace metals [i.e., iron (Fe)] can impact carbonation efficiency. Remobilization of Fe during carbonation of Fe(II)-rich brucite can impact secondary phases formed and, therefore, carbonation rates and capacity.<sup>3</sup> Here we report preliminary results on Mg and Fe partitioning as a function of brucite stoichiometry during carbonation reactions.

Batch carbonation experiments were performed by carbonating synthetic Fe(II)-brucite (5, 20, 40 mol%) in both oxic and anoxic conditions with different background anions at 0.1 M (Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, H<sub>4</sub>SiO<sub>4</sub><sup>0</sup>). Fe(II)-brucite suspensions (5 g in 100 mL of solution) were carbonated for 24 h with 10% CO<sub>2</sub> mixed with 90% N<sub>2</sub>, or 10% CO<sub>2</sub> in compressed air for anoxic and oxic systems, respectively. Water samples were collected over time to quantify concentrations of Mg, Fe, and dissolved inorganic carbon (DIC). Solids were preserved and analyzed by X-ray diffraction (XRD) and X-ray absorption spectroscopy (XAS) to identify the solid reaction products as a function of Fe content.

Preliminary results from combined trace element and spectroscopic analysis indicate the importance of Fe cycling during carbonation of brucite. Our results will have implications for predicting the efficiency of carbonation reactions as a function of Fe content substituted into brucite in both oxic and anoxic conditions.

[1] IPCC (2018) Special Report, Global Warming of 1.5°C [2] Wilson et al. (2014) *Int. J. Greenh. Gas Control*, 25, 121–140. [3] Hamilton et al. (2020) *Econ. Geol.*, 115, 303–323.