Li and Mg-isotopic tracers of fluid mineral reactions in natural analogues for geological carbon storage

ALEX S. MORGAN[1*], EDWARD T. TIPPER[1], MADELEINE S. BOHLIN[1], SAMBUDDHA MISRA[1] AND MIKE J. BICKLE[1]

[1]Dept. Earth Sciences, Downing Street, Cambridge CB2 3EQ, UK (* correspondence asm73@cam.ac.uk)

It is crucial to stabilize atmospheric levels of CO_2 to mitigate global warming. One solution is the permanent injection of captured atmospheric carbon into geologic storage sites. To quantify the long-term success of any carbon storage project, it is essential to understand the nature and rate at which artificially injected CO_2 will react with subsurface fluids and the minerals in the surrounding reservoir. Many of these fundamental fluid-fluid and fluid-mineral processes are still poorly understood. In this study, we have analysed temporal and spatial changes of fluid samples collected from a ~ 10^4 yr old natural CO_2 storage analogue (Green River, [1]) and a CO_2 injection experiment (EOR in the Salt Creek Field, Wyoming [2]) to help model subsurface CO_2 flow and better constrain the reaction rates. Focus is placed on the concentration and isotopic composition data of two stable isotope systems: Lithium and Magnesium. The tendency of these isotopic systems to mass-dependently fractionate during low temperature weathering and reverse weathering (alumino-silicate clay formation) reactions allows them to serve as unique tracers of silicate weathering, and to better track the fate of injected CO_2 at the storage sites.

[1] Kampman et al. (2014) *Chemical Geology* **369**, 51-82. [2] Bickle et al., (2013). Abstract, AGU Fall meeting, V34A.