# Reactive transport modelling of $^{87}Sr/^{86}Sr$ and $\delta^{234}U_i$ evolution in a $CO_2$ rich aquifer: constraint from modern fluids and fossil veins

PETER M. SCOTT[1,2,3], ALEX MASKELL[1], MADELEINE BOHLIN[1], DAN J CONDON[2], ALEKSEY SADEKOV[1,3], MATT HORSTWOOD[2], DIANA SAHY[2], HAZEL CHAPMAN[1], NIKO KAMPMAN[4], MIKE J. BICKLE[1]

[1]Department of Earth Sciences, University of Cambridge, Downing Street, CB2 3EQ, UK pms65@cam.ac.uk
[2] NERC Isotope Geochemistry Lab, BGS, Keyworth, Nottingham, NG12 5GG, UK
[3]University of West Australia, Crawley, WA 6009, Australia
[4]Shell Global Solutions International, Amsterdam, NL

In this study, geochemical gradients of Sr and U isotopes from a leaking $CO_2$ rich reservoir are used to investigate rates of silicate dissolution and fluid flow within an aquifer system at Green River, Utah. This field site is a natural analogue to Carbon Capture & Storage (CCS) allowing insight into the long-term impacts (~1,000-10,000 kyr) of subsurface storage of $CO_2$ on reservoirs and caprocks. $CO_2$ rich brines reach the surface by flow up two fault zones, resulting in modern day springs, and fossil aragonite travertine veins. These veins record historic fluid migration over the last 150kyr [1]. Measurements of both isotopes systems were performed by LA-ICP-MS.

A simplified anlytical solution to reactive transport is derived for both isotope systems, and is calibrated using modern fluid samples and regional hydrologic constraints. The evolution of radiogenic Sr isotopes is used to constrain feldspar dissolution rates along the flow path. As $\delta^{234}U$ is a function of feldspar dissolution and α-recoil the system is fully constrained [2]. This allows estimation of relative flow rates between the present day fluids and the fossil veins which preserve glacial and interglacial variability.

[1] Kampman, Burnside, Shipton, Chapman, Nicholl, Ellam & Bickle, *Nat. Geosci.*, 2012, **5**, 352–358. [2] Maher, DePaolo & Christensen, *Geochim. Cosmochim. Acta*, 2006, **70**, 4417–4435.