

Sr-isotopic ratios trace mixing and dispersion in CO₂ push-pull injection experiments at the Otway Field CO₂ test site, Australia

MIKE J. BICKLE*¹, EMILY I. STEVENSON¹, RALF R. HAESE²,

¹Dept. Earth Science, Univ. of Cambridge, Cambridge, UK,
(*correspondence mb72@esc.cam.ac.uk,
eis22@cam.ac.uk,)

²Peter Cook Centre for CCS Research, School of Earth
Sciences, Univ. of Melbourne, VIC, Aust.
(ralf.haese@unimelb.edu.au)

Modelling the behaviour of soluble aqueous tracers is an essential part of field experiments to determine the distribution of CO₂ and residual, dissolution and trapping mechanisms which will increase the long-term security of geological carbon storage. Here we report the Sr-isotopic analyses on fluids recovered from Tests 1 & 2 of the Otway Phase 2B extension push- pull injection experiments [1]. These comprised two phases of injection (~100t) then phased production of CO₂-saturated water spiked with Sr, Br (Test 1) then Li & Fluorescein (Test 2).

In Test 1 Sr dilutes more rapidly against the volume of produced water than Br, tentatively interpreted to indicate loss of Sr to a reservoir mineral phase [1]. However the Sr-isotopic analyses are consistent with conservative Sr behaviour. In Test 2 (not spiked with Sr) the Sr-isotopic analyses allow deconvolution of the fractions of original formation water, Test 2 injection water and residual Test 1 injection water. In this test the dilution of the injection water recorded by the modelling of Sr is similar to that of Li and SO₄, the latter produced by oxidation of sulphides.

The mixing of all the traces in the Test 1 & 2 experiments against volume of produced fluid is much more marked than subsequent injections spiked with methanol [2]. This may relate to the ~ 10 day pauses between production phases in the Test 1 & 2 experiments and further diffusion or flow-driven mixing during these periods. The results confirm the necessity for isotopic analyses to test geochemical inferences based on concentrations alone.

[1] Black et al., (2017) Int. J. Greenhouse Gas Control 67, 103-110. [2] Serno et al., (2016) Int. J. Greenhouse Gas Control 52, 73-83.