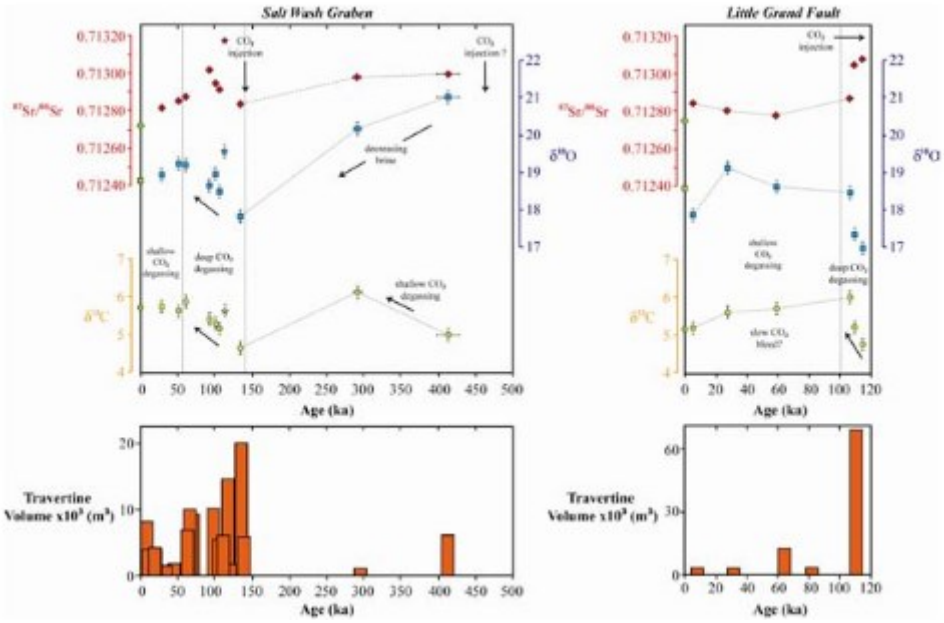
Coupled CO2-leakage and in situ fluid-mineral reactions in a natural CO2 reservoir, Green River, Utah

N. KAMPMAN, N.M. BURNSIDE, M. BICKLE, Z.K. SHIPTON, R.M. ELLAM AND H. CHAPMAN

Surface travertine deposits and carbonate veining within the footwall of Little Grand Fault and Salt Wash Graben, Utah, record a 413 ka history [1] of CO2 leakage [2]. Isotopic analysis of U-series dated carbonate veins reveals a coupling between CO2 injection into the host aquifer and the rates of surface leakage, CO2-promoted silicate mineral hydrolysis reactions within the reservoir [3] and carbonate deposition within fracture conduits through which CO2-charge fluids ascend to the surface (Fig. 1). Rapid carbonate precipitation rates, recorded in the kinetic fractionation of δ13 C HCO3 and δ18 O HCO3 , reflect an increase in in situ p CO2 which elevates concentrations of Ca 2+ and HCO3 - , lowering the point at which the ascending fluid reaches carbonate supersaturation due to CO2 degassing. The spatial and temporal relationship of travertine deposition to CO2 injection, suggests that rapid rates of carbonate deposition initially plug easily exploited leakage pathways causing leakage sites to propagate laterally, but that this blocking rate decreases with dissipation of the CO2 charge. This has important implications for the prediction of leakage behaviour in storage sites and for modeling the coupling of subsurface geochemical processes to the evolution of surface leakage.



[1] Burnside et al. (2009) in Faults & Top seals, EAGE. Montpellier, France.
[2] Dockrill et al. (2010) J. Struc. Geol . in press
[3] Kampman et al. (2009) Earth Planet. Sci. Lett. 284 , 473–488.

Accepted manuscript of the following research output: Kampman, N., Burnside, N. M., Bickle, M., Shipton, Z. K., Ellam, R. M., & Chapman, H. (2010). Coupled CO2-leakage and in situ fluid-mineral reactions in a natural CO2 reservoir, Green River, Utah. *Geochimica et Cosmochimica Acta*, *74*(12 - Supplement), A492-A492. DOI: 10.1016/j.gca.2010.04.036