Natural analogues for carbon capture and storage: U-Th age constraints on fault fluid flow at Green River (UT)

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Carbon Capture and Storage (CCS) will play a key role in reducing anthropogenic CO_2 emmissions. To satisfy regulatory requirements and auditing we need to be able to predict the fate of the CO_2 within geological resevoirs over the ~10,000 years storage times. Trapping mechanisms change through time, but the timescales of these changes are poorly constrained. We also need to understand the mechanisms which control CO_2 flow up potential leakage pathways so that their potential impact may be evaluated and remediation implemented.

The Colorado plateau contains multiple accumulations of CO_2 which have been securely stored for 10^4-10^6 years. At Green River (UT) CO_2 enriched fluids leak up the damaged zone of a fault in the core of an anticlinal trap, resulting in the deposition of travertine mounds and aragonite veins at the surface. This natural analogue allows us to investigate the processes which occur as CO_2 escapes up fault systems.

The travertines preserve a record of these processes over at least ~400 kyr [1]. The U-Th geochronology, combined with travertine chemistry, shows that deposition is pulsed: the greatest rates of formation coincide with the termination of glacial periods [2]. This study is recovering the high resolution time records available from individual veins which allow us to describe the evolution of individual degassing events. Our preliminary U-Th data finds that veins within the mounds typically form for periods of 1 to 3 (±0.2) kyr. The position of these veins and mounds, migrate through time, and suggest that leakage pathways themselves are transient.

[1] Burnside, Shipton, Dockrill, & Ellam, (2013) *Geology* **41,** 471–474. [2] Kampman, Burnside, Shipton, Chapman, Nicholl, Ellam & Bickle (2012) *Nat. Geosci.* **5,** 352–358