SO_2 and O_2 co-injection with potential carbon storage target sandstone from a fresh-water aquifer.

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CO_2 and associated co-contaminant gases such as SO_2, NO_X, and O_2 are present in gas streams from coal fired power stations.[1] The cost of carbon capture and storage (CCS) may be reduced if CO_2 can be stored safely together with the co-contaminants.[2] Reservoir and sealing cap-rock samples from a potential carbon geosequestration site in the Surat Basin, Queensland, Australia, have been subjected to laboratory-scale experiments at simulated in situ CO_2 storage conditions. Water-rock-supercritical CO_2 reactions with co-injected SO_2 gas were performed and compared with pure CO_2 reactions on sister rock samples. Reactions with co-injection of SO_2 indicate hightened divalent cation release from carbonates and silicates (5 – 20 times the reactivity with pure CO_2) (Fig.1.) suggesting potential for enhanced long term mineral trapping of CO_2. Extensive surface corrosion of carbonates and silicates was also observed with the co-injection of SO_2 and a resulting pH of 2-3.

New experiments including the co-contaminant O_2 are expected to significantly stimulate redox reactions and will also be presented.

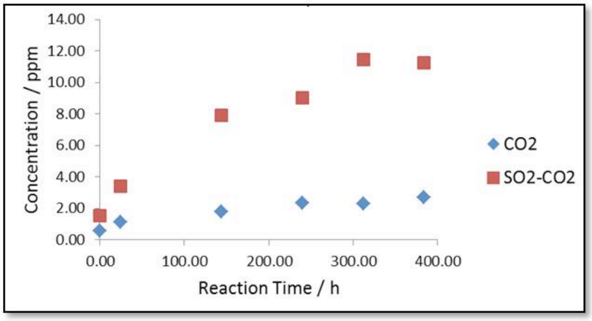

Fig.1: Enhanced evolution of dissolved iron in solution from reservoir rock with SO_2 co-injection (red squares) vs. pure CO_2 storage in situ conditions (blue dimonds).

[1] Xu *et al* (2007) *Chemical Geology* ***242***, 319.[2] Glezakou *et al* (2012) *Geochimica et Cosmochimica Acta* ***92***, 265.

Microstructural Constraints on Porosity Evolution During Carbonate Replacement Reactions

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Volume change during formation and modification of carbonate minerals can lead to significant changes in rock porosity and permeability. In gold mineralising systems these reactions have the potential to enhance wall rock permeability leading to dissemination of gold away from the main fracture-derived fluid pathways. We present quantitative electron backscatter diffraction data combined with spatially referenced major and trace-element chemistry to investigate how porosity evolves during reactions that produce and modify carbonate minerals. Data are presented showing the chemically driven recrystallisation of large (several mm across) calcite grains to produce aggregates of iron-rich carbonate and dolomite. Recystallisation of calcite by siderite occurs by nucleation of new grains that are in low energy crystallographic orientations with respect to the host, preferentially along pre-existing twin interfaces. Dolomite replaces calcite by nucleation on Fe-rich calcite domains in the host grains. Iron in the recrystallised carbonates is sourced from the breakdown large biotite and ilmenite grains (which now form fine grained polycrystalline aggregates as a result of carbonate metasomatism). Gold grains are found at the reaction interface between biotite (reactant) and muscovite (product). Further experimental data will allow kinetics of these reactions to be established, facilitating integration of these reactions with large-scale mineralisation models.

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