Tracking CO₂ injection at Carbfix2 using noble gases and stable isotopes

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Carbon capture and storage (CCS) is required in three of the four IPPC pathways proposed for limiting global warming to 1.5-2°C [1]. Mineral storage of CO₂ in mafic rocks has the potential to offer safe and secure CCS over geological timescales [2]. Results from the Carbfix mineral carbonation field pilot projects in Iceland suggest high percentages of carbon are mineralising within months of injection [3].

Noble gas and stable isotope measurements have been used as effective tracers of subsurface processes and fluids in various geothermal [4] and CO₂ [5] reservoirs. The chemical inertia and distinct sources of noble gases in subsurface fluids, combined with the predictable fractionation behaviour of stable isotopes, provides a powerful tool for tracking the migration and fate of injected fluids [6].

In this study we use combined noble gas and stable isotope measurements to provide further insight into the fate of injected CO₂ at Carbfix2. ³He/⁴He ratios of Carbfix2 injection fluids and gases, production wells and CO₂ monitoring wells fall within the regional range of 12-17R/R for the Western Rift Zone (WRZ) of Iceland. CO₂ monitoring wells show higher ⁴He/²⁰Ne and lower CO₂/³He ratios relative to other production wells and injection fluids, suggesting either He addition or CO₂ loss.

[1] IPCC (2018), Summary for Policymakers — Global Warming of 1.5 °C