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Tracking CO_2 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 CO_2 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 CO_2 [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 CO_2 at Carbfix2. $^3He/^4He$ ratios of Carbfix2 injection fluids and gases, production wells and CO_2 monitoring wells fall within the regional range of 12-17R/R_A for the Western Rift Zone (WRZ) of Iceland. CO_2 monitoring wells shower higher $^4He/^{20}Ne$ and lower $CO_2/^3He$ ratios relative to other production wells and injection fluids, suggesting either He addition or CO_2 loss.

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