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Carbon Dioxide Mineralization in Ultramafic Rocks: Learnings from Field Demonstration Projects

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44.01

Carbon dioxide mineralisation in ultramafic rocks, such as mantle peridotites has emerged as an efficient and safe method for permanent storage of anthropogenic CO_2 emissions. 44.01 conducted a series of CO_2 pilot injection tests in peridotites in Oman and the United Arab Emirates (UAE) to evaluate the feasibility of large-scale CO_2 injection and mineralisation in these unconventional reservoirs. CO_2 was injected fully dissolved in water and conservative tracers were added for hydrodynamical monitoring of the injection fluid. Using chemical and isotopic monitoring data, rapid CO_2 mineralisation has been demonstrated. Mass balance calculations suggest that ~90% of the injected CO_2 was permanently mineralised as carbonate minerals within months after the injection.

A fully-coupled thermo-hydro-chemical reservoir model was developed to history match the pilot injection tests using core data, well-logging, geophysical survey data and borehole test data using the CMG-GEM reservoir model package. Modeling results confirm that dissolution due to the reactivity of the CO_2-saturated injection fluid is localized around the injection well, whereas carbonate precipitation takes place variably in different sectors of the storage reservoir depending on whether it is calcium or magnesium carbonates. Furthermore, the history matched reservoir model was used to simulate long-term CO_2 injection, thereby demonstrating the longevity and large-scale mineralisation capacity of the peridotites.