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From rock to reservoir: Exploring Carbfix application in serpentinite and beyond

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The Carbfix technology is a proven carbon storage method and operating at commercial scale in young basaltic rocks in Iceland. It is based on solubility trapping via the dissolution of CO_2 in water, which is then injected into reactive rock formations forming carbonate minerals thereby promoting long-term mineral trapping.

Natural analogues, experiments, modelling and a limited number of field pilots show that other rock types such as serpentinized ultramafic rocks can work as a reservoir for geological storage via carbon mineralisation. Despite the lower primary permeability in fresh ultramafics relative to basaltic rocks, this study demonstrates that hydrothermal alteration via serpentinization leads to more intense fracturing. As such, reservoirs with high extent of serpentinization may have adequate injectivity. The reactivity of serpentinized ultramafic rocks can also be very high, depending on their protolith and secondary mineral abundances, such as brucite. Brucite forms during serpentinization and is present in serpentinized dunite and harzburgite.

In comparison, mafic rocks become theoretically less suitable with increasing age, alteration and burial, as basaltic glass and primary minerals alter to secondary minerals that are less reactive to CO_2 and limit primary permeability. The influence of local tectonic stresses over time could enhance secondary permeability and compensate for slower mineral dissolution rates. Furthermore, higher temperature gradients can compensate for lower reactivity, as demonstrated by current Carbfix operations in Hellisheidi geothermal field. Results from field work and analysis on ultramafic outcrops, as well as preliminary results from *in situ* testing of dissolution-precipitation reactions on lithologically different samples within actual subsurface CO_2 injection operations will be presented.

As such, evaluating the potential of carbon mineralisation in different rock types requires that both injectivity and reactivity are sufficiently high and considered jointly. Depending on site specific parameters, older rocks of various lithologies and in places with lower geothermal gradient can be assessed for Carbfix potential.