



## Mineral sequestration of carbon dioxide in peridotitic and basaltic rocks using seawater for carbonation

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In-situ mineral sequestration requires huge volumes of water for carbonation of CO<sub>2</sub> which is injected as one fluid phase into the appropriate reactive subsurface for subsequent mineralization. The amount of water needed to dissolve one ton of CO<sub>2</sub> is about 27 tons at 25 bar partial pressure and 25 °C (Gislason et al., 2010). The CarbFix pilot injection project at the Hellisheidi geothermal power plant in SW Iceland taps a shallow aquifer to overcome this critical issue of water demand. Fresh water sources in Iceland are plenty and often replenished. However, areas of basaltic rock suitable for CO<sub>2</sub> mineral sequestration are often situated in more arid climate zones or in areas of high population density with high drinking water demand, e.g. the Indian Deccan Trapps. To overcome this problem, CO<sub>2</sub> can alternatively be dissolved in seawater prior to injection, as the amount of available seawater is practically unlimited. Furthermore, the ocean floor has been discussed as potential CO<sub>2</sub> storage site (Goldberg et al., 2008) conferring seawater a key role in the viability of this trapping technique of carbon dioxide, irrespective of additional technical challenges and costs.

Based on its much higher amount of total dissolved solids seawater displays some different properties from fresh water that may be harnessed to increase the efficiency of fluid-rock interaction and the precipitation of carbonates. Especially some of the seawater anions, e.g., fluoride, sulfate, and organic compounds have been shown to accelerate the dissolution kinetics of basaltic glass (Oelkers and Gislason, 2001; Wolff-Boenisch et al., 2004; Flaathen et al., 2009) and may also potentially enhance dissolution reactions of peridotite or crystalline basalt. Such increased dissolution kinetics would cause a faster rise in pH due to enhanced proton consumption in the dissolution reaction and also increase the amount of solute divalent cations, both crucial processes to successful carbonatization, a pH sensitive process.

The aim of this contribution is to bridge the gap of available studies for basaltic glasses and the lack of kinetics data for crystalline basalt and peridotite dissolution in seawater and in the presence of CO<sub>2</sub>(aq) in order to gain insight into the effects of seawater and its components on the kinetic processes and geochemical interactions that will lead to solid CO<sub>2</sub> sequestration. Results from dissolution experiments in mixed-flow reactors under constant pCO<sub>2</sub> and as a function of seawater solution chemistry with crystalline and glassy basalt and peridotite will be presented and the implications for enhanced in-situ as well as ex-situ CO<sub>2</sub> mineralization discussed.

### References

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