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Experimental determination of the dawsonite dissolution/precipitation rates and their application to CO_2 sequestration

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Dawsonite [$NaAl(OH)_2CO_3$] is a relatively rare mineral that may play an important role in the geological sequestration of CO_2. Thermodynamic and reactive transport calculations indicate that CO_2 injection into Na-rich brines can provoke the dissolution of Al-bearing minerals coupled to dawsonite precipitation. Although dawsonite precipitation is potentially beneficial as a means of fixing the CO_2 in solid form it could also modify porosity and permeability (Hellevang et al. 2005). The relative scarcity of natural dawsonite occurrences, however, suggests that either 1) appropriate CO_2-rich environments requited for dawsonite formation are rare in nature or 2) that dawsonite precipitation rates are slower than indicated by the simplified geochemical systems used in the model calculations. To understand the significance of dawsonite during CO_2 storage, both the thermodynamic and kinetic stability must be known. Although dawsonite solubility is well established (Benezeth et al., 2007), relatively little is known about dawsonite dissolution/ precipitation rates. Towards the better quantification of the role of dawsonite in CO_2 sequestration scenarios we have measured its dissolution and precipitation rates at $3 < pH < 9$ and temperatures ranging from 20 to 80˚C. Experiments were performed in both open and closed system reactors. Results have been used to generate rate equations that can be used to predict the dawsonite dissolution and precipitation rates over the wide variety of conditions found in natural systems. Use of these equations in reactive transport calculations suggest that dawsonite can be instrumental in sequestering carbon in Na, CO_2 brines at alkaline

conditions in both natural and industrial systems.

References:

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Can dawsonite permanently trap CO_2?

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