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Mineralisation from carbon dioxide convective dissolution in a packed bed Hele-Shaw reactor

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Pilot projects to sequester CO_2 in geologic formations as part of Carbon Capture and Sequestration (CCS) efforts to mitigate anthropogenic climate change have obtained evidence of the mineralization of injected CO_2. Basalt aquifers like in CarbFix and the Wallula Basalt Pilot Project contain minerals like olivine which can liberate ions to mineralize and deposit the carbonates as they themselves dissolve. Flow through experiments in olivine show evidence for dual control of carbonation by reactive and transport processes [1] and the modification of the permeability of the host rock [2]. We have investigated the impact of porosity and permeability changes on the spatiotemporal dynamics of mineralization of calcium carbonate formed from the convective dissolution of carbon dioxide. We report our experimental study of convective dissolution of carbon dioxide in a modified vertical Hele-Shaw cell where the carbon dioxide is dissolved into host solutions of different concentrations of dissolved portlandite ($Ca(OH)_2$) which reacts to form solid $CaCO_3$. For the modification of the cell, glass beads of different diameters were packed into the cell in order to vary the porosity and permeability. We show that the precipitation front advances more slowly for the smaller beads as well as for the higher concentrations of reactant.

Time Block Preference

Time Block C (18:00-21:00 CET)

References

1. Peuble, S. et al. CO2 geological storage in olivine rich basaltic aquifers: New insights from reactive-percolation experiments. Appl. Geochemistry 52, 174–190 (2015). 2. Luhmann, A. J. et al. Permeability, porosity, and mineral surface area changes in basalt cores induced by reactive transport of CO 2 -rich brine. Water Resour. Res. 53, 1908–1927 (2017)

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Primary authors: GASKINS, Delora (Université Libre de Bruxelles); DEHAECK, Sam; DE WIT, Anne (ULB)

Presenter: GASKINS, Delora (Université Libre de Bruxelles)

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