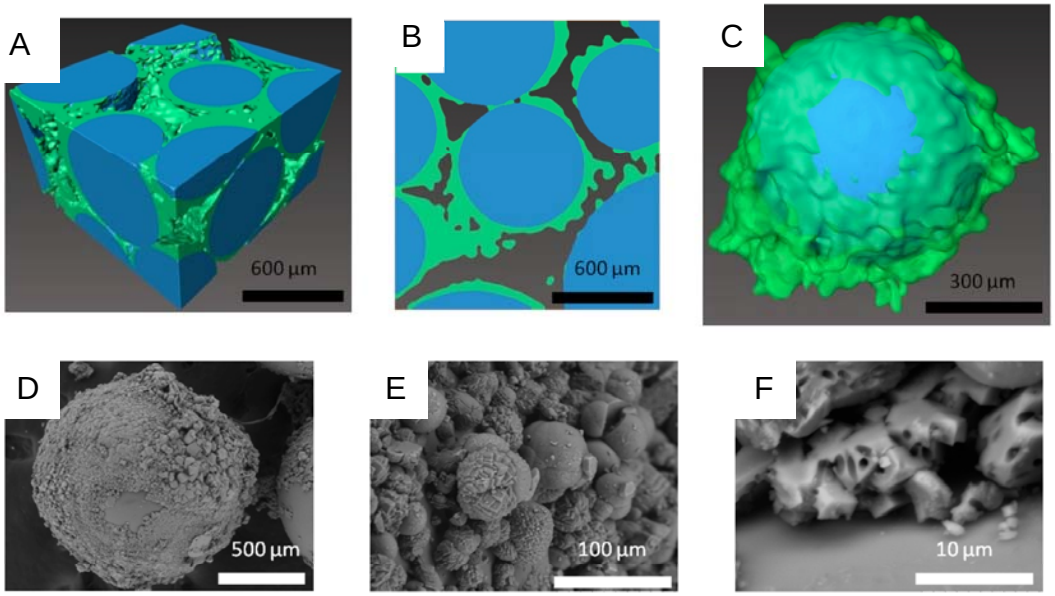
Investigating Carbonate Biomineralization using Synchrotron-based X-Ray Computed Microtomography (sCMT)

- Mineral storage of CO_2, in the form of carbonates, is currently viewed as the most secure long-term solution for carbon emissions. Biogenic $CaCO_3$ mineralization is one approach for rapid precipitation of carbonates; however, the impact of biomineralization on transport properties is not well studied.

- We use synchrotron-based x-ray computed microtomography (sCMT) to investigate changes in pore morphology during $CaCO_3$ biomineralization. We simultaneously examine changes in pore microstructure and bulk permeability within glass bead columns during $CaCO_3$ precipitation induced by *Sporosarcina pasteurii*, a microbial model system for mineralization due to urea hydrolysis.

- We observe a three order of magnitude reduction in permeability over relatively short time-scales (~60 hours) during the carbonate precipitation process; precipitates were observed to be a complex mixture of vaterite and calcite.



- sCMT imagery (A,B,C) were analyzed for changes in pore morphology and structure (throat radii and pore size) and confirmed by SEM (D,E,F). Clogging process was faster than predicted by traditional models.

- Results suggest that biomineralization using such systems might be an effective approach to “patch” breaches in sealing units. Control of rates is a key missing component.

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