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Title:
Elucidating the mineralogical and transport controls on the evolution of porous media using pore scale simulation

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Abstract:
The evolution of porous media due to mineral dissolution and precipitation changes bulk properties of subsurface materials such as porosity, permeability or reactive surface areas. The success of subsurface applications such as CO_2 geological storage is dependent on the evolution of these properties. The physical and mineralogical heterogeneity of porous media exerts controls on porous media evolution via transport limitations to reactive surfaces and mineral accessibility. In these presentation, we use a pore-scale flow and reactive transport model that explicitly tracks mineral surfaces as they dissolve to explore how these controls affect the evolution of the texture in porous media. We show that transport-limited conditions at the grain-pack scale may result in emergent porous media evolution with dissolution concentrated in the fast-flowing paths. However, due to velocities increasing locally the evolving texture is like that observed under conditions closer to strict surface control. Evolving reactive transport regimes also affect local rates in the evolution of media composed of multiple minerals. Faster dissolving minerals may result in non-uniform reactive surface evolution. This increases the

diffusive length between the fracture flow path and the receding reactive surfaces, which cause the dissolution regime to shift from being limited by surface processes to being limited by diffusion. Pore-scale simulation results support experimental observations and conceptual approaches used in recent Darcy-scale continuum models to upscale these processes.