Precipitation in pores

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Mineral precipitation and dissolution in the subsurface, particularly any pore-size dependence will determine how porosity and permeability evolve in response to system perturbations. This in turn will affect contaminant and fluid transport. In this talk I will review the competing theories for the pore size distribution in which precipitation prefentially prefers. Our recent efforts to measure precipitation in nano- and micropores using X-ray scattering will also be presented. Initially, some of our efforts to understand calcium carbonate precipitation in an idealized material, controlled pore glass (CPG), will be discussed. CPG is a nanoporous amorphous silica that contains a single distribution of pores ~8 nm in diameter along with intergranular spaces some tens of micrometers in diameter. Small Angle X-ray Scattering was used to determine the pore-size dependence of the precipitation and composition and crystallinity of the precipitate measured using TEM-EDS and X-ray pair distribution function analysis. Secondly, results on the precipitation of barite (BaSO4) in columns containing glass beads tens of micrometers in diameter will be presented, measured using X-ray computed microtomography. The implications of the different behaviors on these systems will be discussed in light of the competing theories that predict the pore size dependence of how precipitation proceeds. Lastly, some results using small angle neutron scattering to examine precipitation in rocks themselves will be presented.