

How nanominerals form and their role in contaminant cycling.

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The nucleation and growth of initially often poorly ordered or nanocrystalline phases and their transformation to stable minerals in the absence or presence of contaminants, controls the fate of many pollutants in subsurface environments. However, the kinetics and molecular level mechanisms of these formation and recrystallization reactions and their role in the cycling of inorganic and organic pollutants is a crucial knowledge gap that affects our ability to design efficient and effective clean up technologies. Toxic metals and / or organic pollutants can adsorb, become intercalated or structurally incorporated into nanophases during their formation. From the point of view of contaminant clean-up technologies, it is paramount to understand what happens to these compounds during their transformation / crystallization to stable end product minerals. The aim is to test, validate and develop better methods that prevents or delays the release of toxic compounds back into aquifers and promotes their sequestration and permanent removal into stable mineral phases. Using iron- and phosphate-based mineral systems I will discuss how we combined various existing and developed new experimental *ex situ* and novel *in situ* diffraction, scattering, spectroscopy and imaging approaches to follow the formation, transformation as well as fate of for example As, Cd, Pb or Co in both oxic and anoxic environments to derive quantitative kinetic and mechanistic information.