Reactive transport approaches to quantify the linkage between physical structure, biogeochemical reactivity and isotope partitioning in aquifers

Jennifer Druhan

Water is a basic necessity for life, and exerts a primary control on virtually all geological, chemical and biological processes occurring at or near the Earth’s surface. Because these water-rock-life interactions take place at interfaces, both fluid composition and the physical and chemical structure of porous media must be treated as coevolving phenomena. Such complex and interrelated processes can hinder both interpretation and prediction of key environmental processes. One avenue of addressing this complexity is the use of multicomponent numerical methods that combine the governing equations of flow, transport and reactivity. In this presentation I will demonstrate the construction and application of reactive transport models to address key hydrogeochemical problems, with an emphasis on the balance between simulations of complex reactivity versus highly heterogeneous hydrologic conditions. Examples include stable isotope fractionations during microbially-mediated redox cycling and reactivity in highly resolved permeability structures. The goal is to demonstrate how simulations can be used to interrogate complex field data and thus provide new insights into the processes governing hydrogeochemical systems.

Biosketch

Jennifer is an Assistant Professor in the Department of Geology at the University of Illinois Urbana-Champaign. She joined the faculty in 2015 after completing an NSF postdoctoral fellowship at Stanford University. She holds a Ph.D. from the University of California Berkeley Department of Earth and Planetary Sciences and an M.S. from the University of Arizona Department of Hydrology and Water Resources. Her research centers on the relationship between the physical heterogeneity and chemical reactivity of aquifers, and ways in which stable isotope ratios are sensitive to this relationship.