**NAME:** Li Li
**ORGANIZATION**: The Pennsylvania State University
**PROGRAM AFFILIATION:** SBR
**ABSTRACT TITLE:** Effects of illite spatial distribution on Cr(VI) sorption dynamics

**ABSTRACT:** The spatial distribution of clay can have a large impact on the sorption of contaminants, therefore affecting their transport and fate in the natural subsurface. In this work, the effects of illite spatial distribution on Cr(VI) adsorption was examined using column experiments and reactive transport modeling under several flow rate conditions. Three columns were set up with the same volume fraction of illite (10%): the Mixed column has illite evenly mixed within a quartz matrix; the Flow-transverse column has illite distributed in one horizontal zone in the direction that is vertical to the main flow; the Flow-parallel column has illite distributed in one cylindrical zone in the direction parallel to the main flow direction. Cr(VI) adsorption and desorption column experiments were carried out under flow velocities of 0.6, 2.9, and 14.8 m/day. Two-dimensional reactive transport modeling was used to understand the role of illite distribution in determining Cr(VI) sorption kinetics.

The difference in the sorption kinetics in the three columns varies, depending on the flow conditions. Under the slower flow rate of 0.2 ml/min, the Cr(VI) adsorption behavior was very similar for the Mixed and Flow-transverse columns. Sorption of Cr(VI) occurred immediately following the injection of an inlet solution with a pH of 4.0. The sorption occurred fast early on and reached 80% of Cr(VI) sorption capacity of the columns at about 12 residence times. Sorption slowed down after that and reached full capacity with another 30 – 40 residence times. In contrast, sorption in the Flow-parallel column occurred at a much lower rate early on, reaching about 80% sorption capacity within about 30 residence time, about 2.5 times slower than the other two columns. The 2D reactive transport model shows that the Cr(VI) sorption in this column is limited by the rate of mass transport at the illite-quartz interface. Cr(VI) was only adsorbed on the illite-quartz interface early on and gradually percolated into the illite zone over time. The transverse dispersivity, a measure of the mass transport rate, plays a key role in determining the sorption kinetics of the Flow-parallel column. At the flow velocity of 2.9 m/day, the difference among the three columns is similar to the difference at the flow rate of 0.6 m/day. At the flow rate of 14.8 m/day, the three columns show almost exactly the same sorption behavior with overlapping breakthrough curves. With increasing flow rates, the overall sorption capacity of all three columns also decreases.