



Association of Arsenic and Phosphorus with Iron Nanoparticles in the hyporheic zone

Denis O'Carroll (1), Adam Hartland (2), Joshua Larsen (3), and Martin Andersen (1)

(1) University of New South Wales, Australia (d.ocarroll@unsw.edu.au), (2) University of Waikato, New Zealand (ahrtland@waikato.ac.nz), (3) University of Queensland, Australia (josh.larsen@uq.edu.au)

The role of colloids and nanoparticles in hyporheic zone reactive transport is currently poorly understood, and may play an important role in contaminant mobility. The microbial oxidation of organic matter coupled to reductive iron oxide dissolution is widely recognized as the dominant mechanism driving elevated arsenic (As) concentrations in aquifers. This paper considers the potential of nanoparticles to increase the mobility of As in aquifers, thereby accounting for discrepancies between predicted and observed As transport reported elsewhere. Arsenic, phosphorus, and iron size distributions and natural organic matter association were examined along a flow path from surface water via the hyporheic zone to shallow groundwater. Our analysis demonstrates that the colloidal Fe concentration (>1 kDa) correlates with both colloidal P and colloidal As concentrations. Importantly, increases in the concentration of colloidal P (>1 kDa) were positively correlated with increases in the concentration of nominally dissolved As (<1 kDa), but no correlation was observed between colloidal As and nominally dissolved P. This suggests that P actively competes for adsorption sites on Fe nanoparticles, displacing adsorbed As, thus mirroring their interaction with Fe oxides in the aquifer matrix. Dynamic redox fronts at the interface between streams and aquifers may therefore provide globally widespread conditions for the generation of Fe nanoparticles, a mobile phase for As adsorption currently not a part of reactive transport models.