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ABSTRACT TITLE: Fe-oxidizing microorganisms in microscopic model aquifer systems: toward understanding post-biostimulation permeability reduction and oxidative processes at the Rifle IFRC site

ABSTRACT: At the Rifle IFRC, injection of organic carbon stimulates the production of reduced Fe and S chemical species and also results in significant permeability decreases especially within injection wells. Due to the increase in reduced iron species, we predict that iron oxidizing microbes will further contribute to the decrease in permeability during the reoxidation of the aquifer. We first sought to verify the presence of iron oxidizing microbes in the aquifer through culture based methods. Iron sulfide gradient tube cultures inoculated with Rifle groundwater yielded two isolate strains that oxidize Fe and precipitate iron oxyhyroxides. Neither isolate was related to previously identified iron oxidizing microbes. Isolate CD03 is 98% similar to *Curvibacter delicatus*, and P101 #2 is 97% similar to *Hydrogenophaga taeniospiralis*. The isolates are not obligate iron oxidizers, but are also capable of growth on organic substrates and hydrogen. The diversity of metabolisms allow these organisms to adapt to changing geochemical conditions. Next, we designed a flow through culture chamber that allows for imaging of sediment pore space with multiphoton confocal microscopy. Our goal is to visualize the distribution of cells and biominerals in relation to the pore structure, to gain insight into Fe oxidizer controls on aquifer permeability reduction. We packed the chamber with Nafion, an optically transparent polymer which allows us to image pore spaces. Rifle isolates were inoculated into the simulated aquifer system, then growth media was injected at a constant flow rate. We will present our results demonstrating the distribution of cells and biominerals in pores/pore throats and resulting changes in pore scale architecture.