IN SITU REACTION RATES FROM A FIELD BIOSTIMULATION EXPERIMENT

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It is well known that the rates of microbially catalyzed biogeochemical reactions in laboratory incubation studies are 2 to 5 orders of magnitude higher than in situ rates in aquifers. This discrepancy partly reflects the complexity of geological systems. Typically, redox sensitive constituents such as uranium (U) and technetium (Tc) are found at very low, yet hazardous concentrations, whereas other redox-sensitive elements such as sulfate and nitrate are much more abundant, and aqueous redox reactions in the aquifers occur in a complex solid matrix with different species and crystallinities of iron and manganese oxyhydroxides. Here we report a push-pull biostimulation test and in situ chemical reaction rates in a groundwater system that are too complicated to be duplicated by laboratory experimental methods. Nutrients were added to the system to increase the activity of the native microbial population to such a degree that the competitive terminal electron acceptors were depleted through a sequence of microbially mediated redox reactions, allowing for the reduction of U(VI) and Tc(VII), NO_3^-, SO_4^{2-}, and Fe and Mn oxyhydroxides. We will show the derived in situ rates and geochemical modeling to simulate the biogeochemical processes.