Role of sulfate-reducing bacteria (SRB) in Fe and S mineral transformation in the AMD-impacted environment

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Fe(III) hydroxysulfate minerals are secondary minerals commonly found in acid mine drainage (AMD) sites. Microbe-driven transformation of iron (Fe) and sulfur (S) bearing minerals is an important process, regulating the biogeochemical cycle of Fe and S, controlling the behaviour of associated metals/metalloids. So far, the role of SRB in transformation of Fe and S minerals in the AMD-impacted environment are less known. Our microcosm investigation of AMD-affected sediment showed that indigenous iron and sulfate-reducing bacteria promoted the mineralogical transformation of schwertmannite/jarosite with the accumulation of Fe(II) and sulfide. We further examined the transformation of schwertmannite and jarosite by a sulfate reducing culture with direct or indirect contact with the mineral. Vivianite was detected as the main product of schwertmannite transformation, while jarosite was transformed to vivianite, mackinawite and pyrite. Microbial community composition differed in direct and indirect treatments. The growth of *Desulfovibrio* sp. or *Desulfosporosinus* sp. dominated in direct treatments, while *Citrobacter* within *Enterobacteriaceae* was predominant in indirect treatments. PICRUSt results implied that bacteria in indirect treatment have potential to produce shuttling compounds or complexing agents, promoting the dissolution and transformation of minerals. A strain of facultative anaerobic *Citrobacter* with sulfate reduction ability was then isolated from the indirect treatment to further investigate the mechanism of mineral transfromation. *Citrobacter* spp. was able to form corrosion pits on the surface of ferrihydrite but could not reduce Fe(III). In the presence of sulfate, the surface of ferrihydrite is rapidly attacked by S^{2-} and transformed into lepidocrocite, resulting in a large amount of mackinawite. Large amount of substances were detected by UV-scanning absorption spectrum, which may prompt *Citrobacter* spp. to tranfrom the minerals in the indirect treatment. More results will be discussed in the conference. The present study provides a new perspective for the biogeochemical cycle of Fe and S and the mineral transformation under reducing environment of the mining area.