Microbial Ecology of Seleniferous Reclaimed Mine Soils

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Worldwide, selenium (Se) is proving to be a significant environmental concern, with many anthropogenic activities (e.g., coal mining and combustion, phosphate mining and agricultural irrigation) releasing potentially hazardous concentrations into soil and natural water ecosystems. Specifically in southeastern Idaho, historic and on-going phosphate mining have resulted in Se-enriched soils throughout the region. Such metal(loid) contaminated environments have frequently been shown to have altered soil microbial community structures, though few studies have investigated the interaction of Se with aerobic soil microbial communities. Numerous anaerobic bacteria are known to mediate Se redox reactions in anoxic environments, and recent work has shown that fungi can aerobically reduce Se oxyanions to elemental Se and volatile Se(-II). The goal of this study is to investigate the aerobic microbial (bacteria and fungi) communities present in Se-containing surface soils, and the role these communities have on Se geochemistry in these soils.

Both culturable and non-culturable microbial communities were assessed in soils collected from two reclaimed mine soils in southeast Idaho, USA. Additional unmined reference soils near the mines were also collected and analyzed. Soils were collected over the course of two years, and total microbial DNA extracted. Amplicon sequencing of bacterial and fungal DNA was performed using 16s rRNA gene sequencing (bacteria) and internal transcribed spacer (ITS) sequencing (fungi). Results show that the bacterial community is relatively similar across all sites (mined and unmined) though fungi in reclaimed mine sites have substantially greater relative contribution of Ascomycete fungi than Basidiomycete fungi. Additionally, increasing Se concentration in the soils was linked to lower overall fungal community diversity, while other geochemical parameters such as pH were not correlated at all to microbial community diversity. Understanding the microbial ecology in seleniferous soils will help to address Se-contamination and limit Se mobility and toxicity in sensitive environments.