The Influence of Bacteria on Passive Remediation Systems[1]

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Abstract: Passive remediation systems are increasingly becoming a cost-effective choice for treatment of abandoned mine drainage. Their ability to remediate both acidic and circum-neutral discharge has proven to be successful. Currently, these systems are designed based on geochemical processes, with minimal regard to the naturally forming microbial communities. We aim to identify the roles microbial communities, specifically bacteria, play in passive remediation systems. We designed an in vitro system to determine the influence bacteria have on soluble iron, manganese, and sulfate levels in two passive remediation systems in Pennsylvania that treat acidic mine drainage (Boyce and Middle Branch). Slurries were taken from settling ponds throughout the remediation systems, sterilized and reinoculated with bacteria from different points in the systems. Enrichment studies were also performed to identify the potential for mine drainage constitutes to shape bacterial communities. We found that bacteria have the ability to both negatively and positively influence the removal of contaminants from the passive remediation systems. Biologically-driven iron-oxidation that resulted in iron precipitation was observed in both systems, while Middle Branch also had manganese-reduction that led to resolubilization. Our findings suggest that the microbial communities in remediation systems can have both positive and negative effects on contaminant removal. Further understanding of the microbial communities present in passive remediation systems could help to improve system performance and longevity.[3]

Additional Key Words: Abandoned Mine Drainage, Microbial Communities, Bioremediation.

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3. Work reported here was conducted at Boyce Park AMD Passive Remediation System (40.463740, -79.748558) and Middle Branch Passive Remediation System (41.344826, -77.867146).