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Metal Loading Dynamics in the Hyporheic Zone as a Result of Acid Mine Drainage

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Acid mine drainage (AMD) and acid rock drainage (ARD) pose significant environmental challenges. As the acidic, metal-laden drainage seeps into surface and groundwater systems, the result is often substantial ecological damage. The hyporheic zone, where surface and groundwater meet, serves as a natural filtration system, where biogeochemical reactions occur that influence metal retention and transformation. By analyzing changes in metal concentrations and phases throughout time and space, valuable information can be gained in regards to the mechanisms at work within the hyporheic zone. This knowledge is critical for the development of remediation plans for AMD and ARD affected sites, such as Coal Creek, the source of drinking water for the town of Crested Butte, Colorado. The ability to protect the potability of Coal Creek is vital for both safeguarding public health as well as maintaining ecosystem integrity. In order to better understand the complexities of this dynamic system, hyporheic sediment and sediment from planted control soil columns were sampled on a seasonal basis. Samples were analyzed for phase changes via XRD and SEM and sequential extractions created using the samples were analyzed via ICP-OES for elemental fraction concentrations. Preliminary results show the retention and release of metals, particularly iron, through various phase changes occurring within the hyporheic zone. These changes are seasonally dynamic and vary from site to site along the creek, illustrating the capacity of the hyporheic zone to act as a filter for AMD in different capacities throughout different points of the year.