

Insights into sulfur biogeochemistry in alkaline, carbonate-depositing headwater streams

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Sulfur is a highly reactive element and its biogeochemical cycle is often linked to those of carbon, nitrogen, and/or phosphorus. While most studies of sulfur biogeochemistry in aquatic ecosystems pertain to the effects of acid rain or acid main drainage, we consider sulfur cycling in alkaline streams.

For over three years (2011 – 2014), we monitored stream water chemical composition in headwater streams in the Huachuca Mountains of southern Arizona, USA. These montane streams are characterized by low nutrient concentrations and active calcium carbonate deposition. We present results that suggest that calcium carbonate deposition may be influenced by sulfate reduction. Across the streams, sulfate concentrations are positively correlated with calcium concentrations ($r^2 = 0.45$, $p < 0.001$). Within a stream, downstream changes in sulfate and calcium concentrations are stoichiometrically constrained: 5 mol of CaCO_3 are produced per 1 mol of sulfate consumed. As calcium carbonate deposition can influence phosphorus availability through co-precipitation of phosphate, a link between microbial sulfate reduction and calcium carbonate deposition may be another way in which sulfur, carbon, and phosphorus cycles are coupled.