Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.10603

Formation, degradation, and preservation of biogenic sulfur in an acidic sulfur spring

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The microbial production and extracellular deposition of elemental sulfur (S(0)) is both a phylogenetically and environmentally widespread strategy among sulfur-oxidizing bacteria. Once deposited, biogenic S(0) can either be transformed into other sulfur species, or preserved into a more recalcitrant, often crystalline form. The fate of biogenic S(0) can have considerable consequences for S-cycling. If S(0) is preserved in a recalcitrant form, it can be effectively removed from the active S-cycle. If biogenic S(0) is in a less crystalline state, it is more likely to remain susceptible to microbial and geochemical transformations. However, the conditions in which biogenic S(0) is preserved are not well constrained.

The Oak Orchard Acid Springs (Basom, NY) are a set of acidic sulfur springs in a freshwater wetland with extremely low microbial diversity. This simplified microbial ecosystem makes the springs an excellent system for studying cell-sulfur interactions and the preservation potential of extracellular biogenic S(0) in acidic conditions. The springs are dominated by *Acidithiobacillus* spp. and contain conspicuous accumulations of S(0), largely in globular form. This sulfur is often associated with “rafts” of cells surrounding globules, suggesting its potential as either a byproduct of energy metabolism or its use as an electron donor. We have isolated four *Acidithiobacillus* strains from the springs to further investigate cell-S(0) interactions. Three of the strains are capable of extracellular S(0) globule production and all strains can degrade S(0) in aerobic conditions. Future work will involve tracking spatial relationships between cells and sulfur, and determining how these dynamics change between globular and crystalline forms of S(0).