Sulfur intermediates as new biogeochemical hubs in aquatic ecosystems

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Abstract

The sulfur cycle involves a series of complex aerobic and anaerobic transformations of sulfur-containing molecules. Sulfur transformations are fundamental to cellular and ecosystem-level processes, influencing biological carbon transfers and other biogeochemical cycles. Yet despite the importance of this pathway, the microbial communities and metabolic pathways involved remain poorly understood. A recent study examined these features in an extreme geochemical environment: isolated, ice-capped Lake A in the Canadian High Arctic. Using complementary molecular approaches, researchers found a sharp contrast in the microbial communities and metabolic potentials in the distinct water layers in Lake A. Throughout all layers, sulfur cycling genes were abundant. Oxidative processes were enriched in samples from oxygen-rich freshwater-like layers, while reductive reactions were enriched in the anoxic and sulfidic bottom layers. Up to 154 different genomic bins with the potential for sulfur transformation were identified, revealing a diverse array of microorganisms capable of performing sulfur reactions, and genes for the utilization of sulfur cycle intermediates were widespread throughout the water column. While further studies will focus on confirming the metabolic activity of these microorganisms, the results suggest that sulfur cycle intermediates and organic sulfur molecules are utilized by a diverse group of microorganisms in association with the classical sulfur cycle.