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Microbial habitability of Black Hills caves: a geochemical perspective

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The Black Hills of South Dakota contain extensive natural cave systems, including some of the longest mapped caves in the world. Carbonate caves globally are are known to host a diversity of microorganisms; however, we know comparatively little about the biology and geochemistry of caves in the Black Hills region. As a first step towards exploring the diversity of microbial life in natural subsurface systems, the geochemistry of five caves along the eastern margin of the Black Hills was evaluated. Major and trace element geochemistry, organic and inorganic carbon of waters and sediments indicate that caves are geochemically distinct, despite close geographic proximity and development within the same geologic unit (Pahasapa Formation). Some of the main factors separating caves in multivariate analysis include air CO2, water nitrate, calcium, magnesium, manganese, and sulfate concentrations, as well as water and sediment organic and inorganic carbon content. Collectively, the results of this study can be used to guide predictions of microbial metabolic processes likely present in each cave, and the potential for larger trends in subsurface biodiversity throughout the region. Future work includes evaluating microbial community composition and metabolic functioning to better understand Black Hills caves as subsurface habitats for life.

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