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Microbial Bioindicators for Lithium in Freshwater Environments

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Lithium (Li) is a critical metal for low-carbon energy systems, yet environmentally sustainable exploration tools remain limited. The Magaguadavic River (southwestern New Brunswick, Canada) flows through Li anomalies in glacial till [1,2] and past Li-rich granites both downstream and to the north within the watershed [3]. In this region, Li is hosted primarily in zinnwaldite, a potassium–lithium–iron–aluminum mica. To evaluate whether environmental DNA (eDNA)–based microbial community profiling could serve as a bioindicator of buried Li mineralization concealed beneath glacial till, we conducted a reconnaissance-level study along the Magaguadavic River. This survey integrated 16S rRNA metabarcoding of stream sediments and waters with aqueous and sediment geochemistry, complemented by regional glacial till datasets [1].

Microbial communities display strong, systematic responses to Li concentrations in till, indicating that watershed-scale geochemical gradients exert major controls on community structure. Sediment communities exhibit larger compositional shifts than water-column communities, likely reflecting greater physicochemical heterogeneity, longer residence times, and enhanced interaction with Li derived from weathering tills. These inputs—delivered through both slow mineral breakdown and rapid surface reactions—shape Li bioavailability across multiple temporal scales.

Taxonomic shifts along Li gradients reveal that some microbial groups respond consistently across sediments and waters, whereas others change only within a single environment. These differences suggest distinct ecological niches and exposure pathways to Li. Collectively, the results demonstrate that microbial community structure reflects subsurface Li signatures. Environmental DNA profiling therefore shows promise as a low-impact, scalable approach for detecting buried Li mineralization in glaciated terrains. Beyond exploration, this work advances understanding of Li-related microbe–metal–mineral interactions and may inform environmentally responsible strategies for assessing critical-metal resources.

[1] Gilmore, W. (2025) Open File Report OF 2025-5 (New Brunswick Department of Natural Resources)

[2] Rossiter, S. (2023) Open File Report 2023-3 (New Brunswick Department of Natural Resources).

[3] Taylor, R. P. (1992) Can. Mineral. 30, 895–921 (1992)