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Assessing the Efficiency of Phytogeochemical Mineral Exploration

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Vegetation cover poses a significant challenge in geological surveys. Utilizing plant chemistry to detect underlying geological features offers a non-invasive exploration tool. Here, we employ a novel approach in biogeochemical data analysis to distinguish between mineral deposits, and bedrock void of mineralization. Different plant species and tissues exhibit distinct element compositions in a multivariate hyperspace, making direct comparisons in terms of absolute concentrations challenging. Our approach aims to overcome this traditional constraint by analyzing biogeochemical datasets irrespective of the specific species and tissue collected, as we will account for the physiological variations through data preprocessing. We use principles of compositional data analysis to transform biogeochemical datasets, enabling comparability across different sample materials and other plant datasets.

The corrected biogeochemical dataset for the sample type was analyzed using Linear Discriminant Analysis to identify element associations indicative of differences between samples collected over mineralized bedrock and those from rocks void of mineralization (barren). Results show differences in group means between samples sourced from pillow basalts and mafic rocks compared to their their mineralized counterparts, distinguishing between mineralized and mineralization-free samples. For example, when comparing element ratios of Cu, Ca, and Rb to P and Sr, differentiation is observed across six distinct plant materials between barren pillow lavas and the corresponding mineralized bedrock.