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Glimmerite and Associated Alkaline Intrusions Northwest of La Tuque, Grenville Province: New Mineral Data and Geochemical Constraints

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Alkaline rocks, while volumetrically minor within the global igneous rock record, are of considerable importance from both scientific and economic perspectives. They record key mantle processes and commonly host critical-element mineralization. Their mineralogical and geochemical signature, characteristic of a major reservoir for critical metal mineralization provides insights into the processes responsible for enrichment in alkali metals, rare earth elements, Nb, Ta, Zr, and other high-field-strength elements. Glimmerites represent an end-member of alkaline ultramafic magmatism, characterized by a phlogopite-dominated mineralogy and remarkable enrichment in alkali metals.

In this study, we combine field observations and geochemical analyses to characterize alkaline ultramafic intrusions identified northwest of La Tuque (Quebec), within the central Grenville Province, field observations show that the glimmerite occurs as discrete bodies, spatially and structurally associated with alkaline mafic intrusions. The mineralogical assemblages, dominated high-Mg phlogopite (Mg# = 83.06–88.33) associated with clinopyroxene and alkali feldspar, are consistent with crystallization from alkaline magmas rather than with metasomatic overprinting, and the cumulate textures of pyroxene, observed in petrography, further confirm an igneous origin. The geochemical composition of these rocks is characterized by high alkali contents and coherent variations in major and trace elements, positioning these intrusions among the most extreme manifestations of the alkaline spectrum in the province. These rocks are associated with magmatism related to later intraplate rifting, passive margins, and collisional orogens. Their study enhances the documented diversity of alkaline ultramafic rocks and refines our understanding of the tectonomagmatic conditions that controlled their genesis and mineralization in the Grenville Province.