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Mineralogy and Whole-Rock Geochemistry as Exploration Tools for Lithium Pegmatites in Ghana: Examples from the Biriwa-Ewoyaa Pegmatite Fields

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Due to its importance for the green energy revolution supported by UN SDG 7: Affordable and Clean Energy, lithium (Li) is attracting interest on a global scale. The worldwide search for Li ore has expanded tremendously as a result of the anticipated huge demand for Li-based technological products. In-depth investigation of the origins, enrichment, and exploration of this rare metal in Ghana has been prompted by the discovery of Li ore in pegmatites. This paper provides preliminary field observations, petrographic studies, and interpretations of the major and trace element concentrations to understand the petrochemical character of the pegmatites and its implications for the evolution and enrichment of Li.

The pegmatites in the Ewoyaa and Biriwa areas, respectively, are associated with Birimian mica schists in the Cape Coast basin, Central Region of Ghana. Although both pegmatites are composed predominantly of quartz, K-feldspar, albite, and muscovite, the pegmatites at Ewoyaa additionally contain spodumene and relatively rare-to-no biotite while the pegmatites at Biriwa contain appreciable amounts of biotite. The geochemical data indicates that both pegmatites are granitic and peraluminous. Standard-normalised diagrams reveal similar distribution patterns for REEs, LILEs, and HFSEs. In contrast to the pegmatites at Biriwa, evolution may have influenced the enrichment of Li, Cs, Ta, Sn, and Rb and depletion of Ba, Cr, Nd, Sr, and REEs in the Ewoyaa pegmatites. Although the source (whether sedimentary or igneous) of Li in the granitic magma is currently not clear, the enrichment of Li and other rare metals in the Ewoyaa pegmatites was most likely caused by fractional crystallisation of Li-rich pegmatitic melt. The differences in elemental concentrations enabled binary plots of elemental ratios that clearly distinguished between mineralised and barren pegmatites, which would be very useful in target mineral exploration programs for mineralised pegmatites in the region and elsewhere in the world.