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Recent investigations for lithium mineralization in the Agboville and Boundiali regions of Côte d'Ivoire: implications for the global energy transition

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The growing demand for critical raw materials, particularly lithium and tantalum (essential for battery technology and renewable energy storage), is currently being driven by technological developments linked to the global energy transition, which is one of the most important aspects of the 21st century. Sustaining this demand requires understanding the geological formations potentially favorable for these materials, particularly pegmatites, which represent a primary source. In Côte d'Ivoire, pegmatite occurrences have been the subject of limited studies. Fifteen (15) zones of interest have been identified, of which only those in the Issia locality, formed from differentiated residual fluids related to the crystallization of the Issia peraluminous granite, have undergone rigorous study, revealing columbite-tantaliferous deposits with limited lithium enrichment. Recent petrographic investigations in the Boundiali and Agboville regions have identified various rare-metal-rich pegmatites that are highly prospective, particularly for lithium mineralization (spodumene and lepidolite minerals). These pegmatites intrude Birimian (Paleoproterozoic) formations, either within parametamorphic units (schist and amphibolite) or in granitic bodies. Thin-section analyses highlight five main types of pegmatite: spodumene-bearing, lepidolite-bearing, green-mica-rich, garnet-rich, and barren. The mineral assemblages and textural features suggest a complex geological history involving (i) magmatic crystallization (quartz, feldspar, spodumene, and muscovite), followed by (ii) regional metamorphic decompression and metasomatic fluid interactions, including chemical exchange between spodumene and fluids, leading to the formation of SQUI texture (vermicular intergrowth with small quartz crystals) and myrmekite textures; (iii) hydrothermal alteration, such as sericitization and montmorillonite replacement; and (iv) surface weathering, evidenced by eucryptite indicating potential lithium mobility and by hematite and rutile formation. The abundance of metasomatic features (sericitization, myrmekite, SQUI texture) underscores the role of fluid recirculation and redistribution of rare metals.