

LCT Pegmatite in the West African Craton: New Insights on the Metallogenic Context and Exploration Approach Based on the Issia District (Ivory Coast)

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The West African Craton has demonstrated to be highly prospective for lithium-cesium-tantalum (LCT) pegmatite, with recent discoveries of large lithium resources in Mali (Goulamina and Bougouni projects), Ghana (Ewoyaa project), and other exploration projects in Ivory Coast (Issia and Atex projects) and Senegal (Saraya project). New insights on the metallogenic context predominantly suggested an anatectic model for the petrogenesis of these LCT pegmatites either derived from metasedimentary or igneous protoliths and controlled by late deformation stages of the Eburnean orogeny (peak at c. 2050 Ma). At the Craton scale, mineral prospectivity analysis and predictivity modeling combining knowledge-driven and data-driven approaches identified a series of key criteria (density of mineral occurrences, age and typology of granite, late Eburnean structural pattern, and specific gravimetric and magnetic signatures) allowing the delineation of prospective areas. At the prospect scale, such as in the Issia area (Ivory Coast), and in contrast to well-exposed LCT pegmatite districts in Namibia and Zimbabwe, indirect geochemical exploration within undercover lateritic environment appeared to be a powerful tool to identify proxies towards LCT pegmatite corridors within prospective metallogenic context highlighted by predictivity modeling. The combination of stream-sediment, soil and rock-chip to trench sampling provided a strong support in targeting fractionated and rare metal-rich pegmatite source rocks, focusing on Li-Cs-Ta-Nb-Be-Rb-Sn-Mn-Ga geostatistical association and geochemical tracers such as K/Rb, Nb/Ta, Zr/Hf, and Rb/Sr ratios. In targeted anomalous areas, systematic mapping and sampling of outcropping pegmatites were performed along with detailed petrographic description focusing on primary magmatic textures versus magmatic-hydrothermal alterations (albitization, greisenization) that could have positively or negatively impacted the economic potential of the lithium mineralization. This multimethod and multiscale approach has major implications for grassroots exploration of LCT pegmatite elsewhere in Paleoproterozoic terranes, especially where indicators of anatexis of fertile sources are still preserved.