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REE mineralization in the Eastern Dharwar Craton at Mincheri, Raichur District, Karnataka, India

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The Eastern Dharwar craton is considered as a collage of various granites (2.5 – 2.7 Ga) and greenstone sequences derived possibly in an Archaean subduction zone setting. The northern margin of the craton is affected by the Krishna Lineament, coincident with the ENE-WSW course of Krishna River, which is linked to the intrusion of kimberlite, lamproites and several base-metal prospects. In the west-central part of the lineament, a swarm of complex pegmatites and quartz veins occurs across the Krishna Lineament at Mincheri. These pegmatites intrude the country rock which is dominated by biotite-hornblende gneisses of ~3 – 3.1 Ga Peninsular Gneissic Complex (PGC), often having patchy (plug like) occurrences of K-feldspar and aegirine-rich syenite. Low exposure density imposes a major constraint on establishing a genetic link between the PGC-syenite and pegmatite bodies. The N-S trending pegmatite and quartz bodies are invariably associated with hydrothermal quartz breccia and exhibit pinch-and-swell structure.

The pegmatite body (1-8 m wide and 1.3 km long) west of Mincheri contains between 1.228 and 25.289 % Σ REE, with high LREEs (La, Ce, Pr, Nd, Eu, Sm, Gd) and low HREEs (Tb, Dy, Ho, Er, Tm, Yb, Lu) suggesting their affinity to the Li-Cs-Ta (LCT) family of rare element pegmatites. The REE mineralization is concentrated in the western margin of the pegmatite body with the granite gneiss having larger enclaves of amphibolites. The contact is often marked by brittle-ductile deformation possibly induced during pegmatite intrusion. The REE-rich portions of the pegmatite are generally black in colour, and massive with conchoidal fractures. Petrographic studies helped in identifying apatite, sphene, xenotime and monazite as primary REE-bearing minerals. XRD and EPMA studies confirmed the presence of REE minerals like yttriofluorite, gadolinite, britholite, cerianite, barite, allanite, monazite and bastnaesite. The allanite grains are observed replacing aegirine in pegmatite. Fluid inclusion studies have revealed the presence of CO₂-rich vapour and aqueous phases with homogenisation temperatures varying from 128 to 349°C. The recorded values of temperature of homogenisation vs. salinity suggest mixing of fluids with low to high salinity at moderate temperature. The presence of aegirine in the LREE-rich Mincheri pegmatite and the close association of pegmatite and quartz veins with K-rich syenite corroborate the genetic link with the 2.5 Ga Closepet Granite and its variants in the Eastern Dharwar Craton (EDC).

