

Geochemistry and Mineralogy of Dolocrete Covering REE ore deposit at Mt Weld, Western Australia

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Carbonatite-hosted REE deposits are intensely weathered and often covered by a thick sequence of sediments hindering exploration. At Mt Weld (Western Australia), a layer of lens-shaped dolocrete (up to 25 m) covers the carbonatite-hosted rare earth elements (REE) ore deposit. The carbonatite comprises an annulus of REE-poor calcite carbonatite (~4 km) and a core of REE-enriched ferroan-dolomite carbonatite (FDC) (~1.5 km). The dolocrete is wedged between overburdened alluvium and underlying caprock and REE-rich saprolite. It covers the entire FDC and is subdivided into three units: (i) a massive Upper White Dolocrete (UWD) containing dolomite, palygorskite and traces of quartz, REE-aluminophosphates, Nb-rutile, Nb-bearing ilmenite, monazite, and pyrite; (ii) yellow to light brown Middle Pisolite Dolocrete (MPD) hosting dolomite associated with allogenic quartz, REE-minerals (e.g. monazite and florencite-Ce), Nb-rutile and ilmenite, Fe-oxides nodules, and rare authigenic cerianite; and (iii) a dark reddish brown Basal Breccia Dolocrete (BBD) that contains dolomite, clays and ironstone clasts with inclusions of quartz, REE-minerals, Nb-minerals, baddeleyite, and zircon. The MPD and BBD units experienced partial dissolution and the formation of micro-to-centimeter scale porosity (~10 vol.%). The secondary veins of UWD cross-cut MPD and BBD. The REE- and Nb-minerals in the BBD are the same as those in the underlying regolith. Stoichiometric dolomite (based on XRD) is the dominant carbonate in dolocrete (Ca/Mg=1.01–1.10). The size of the zoned subhedral dolomite crystals in UWD varies from 5–50 µm; in MPD and BBD, it is 5–150 µm. The concentration of FeO (in wt.% by EPMA) in dolomite increases with depth from below detection (bd)–0.5 (avg.=0.14) in UWD, 0.1–1.7 (avg.=0.65) in MPD, to 0.1–2.4 (avg.=0.89) in BBD. A decreasing La_N/Lu_N ratio (normalised to Upper Continental Crust) from FDC (165.42) upwards, i.e., BBD = 97.98, MPD = 16.31, and UWD = 6.62, suggests that the LREE-enriched signature of the original FDC is lessened in dolocrete and points towards assimilation of the extremely