

Age and origin of the Yangibana LREE deposit and associated ferrocarnatites, Gascoyne Province, Western Australia

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The Yangibana LREE deposit is hosted within the Proterozoic Gifford Creek Carbonatite Complex (GCCC) of the Gascoyne Province, Capricorn Orogen, Western Australia. At the prospect scale, REE mineralisation is hosted in “ironstone” dykes and sills that intrude the rocks of the GCCC [1]. The “ironstones” are heavily oxidized dykes and sills composed mainly of hematite, quartz, clay minerals, monazite and apatite. Based on detailed mapping of field relationships, we show that the “ironstones” emanate from ferrocarnatites of the GCCC. The ferrocarnatite dykes are composed of dolomite, ankerite, siderite, riebeckite, aegirine, annite-phlogopite, apatite and monazite. Both the “ironstones” and ferrocarnatites are enveloped by K-dominant, fenite alteration. Whole rock and trace element geochemical transects conducted across the “ironstones” show depletions of Si, Al, Ca, Na, K, Rb, Ta, and W and enrichment of Mn, P, Sr, Fe, Ni, Cu, Zn, Sr, Pb, Th, U and the REEs when compared to least altered samples. Similar transects conducted across the ferrocarnatites show similar, though less pronounced, patterns.

In order to determine the source of the ferrocarnatites, in situ Sm-Nd isotope studies (using LA-ICP-MS) were conducted on monazite-apatite pairs. The Sm-Nd analyses yielded values of $\epsilon_{Nd} = -3.73 \pm 0.3$ and an isochron age of 1262 ± 17 Ma. The results indicate a significant crustal input during the emplacement of the ferrocarnatites. In situ U-Pb dating and Lu-Hf isotope analyses (using LA-ICP-MS) were conducted on zircons found in veins related to the ferrocarnatites. The age for these zircons was found to be 1378 ± 17 Ma with $\epsilon_{Hf} = -2.55 \pm 0.4$. These two ages indicate that the emplacement of the ferrocarnatites and related REE mineralisation were associated with the Mutherbukin Tectonic Event (1385–1200 Ma). Nevertheless, the difference between the two ages (~100 m.y.) shows that there were at least two stages of magmatism/hydrothermal activity in the region.

[1] Pearson *et al.* (1996), *Aust. J. Earth Sci.* **43(3)**, 299-309.