

Rare Earths, Apatites and Carbonatites: A Tale from Montviel REE-Nb Deposit, Québec, Canada

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Montviel is a Paleoproterozoic (1.894 Ga) Alkaline-Carbonatite Complex located within the eastern section of the Superior Province, northern Quebec, Canada. The complex is dominantly composed of silica-undersaturated alkaline- and carbonatite intrusions, which were enriched in rare earth elements (REE) and Nb through three discrete mantle injections. To date, Resources Géoméga has undergone three drilling phases, totaling 90 holes and 36.3 km of core, and providing a resource estimate of 250.6 Mt of ore at 1.46 wt. % total rare earth oxides. Géoméga published a pre-economic assessment in May 2015 showing a recovery of about 90% REE by using environmentally friendly hydrometallurgical processes. However, the resource estimate and the metallurgical tests were made without considering apatite as a potential ore mineral. The present study shows that at Montviel, apatite was first magmatic but was metasomatized as dense, widespread clusters coexisting with minerals such as biotite and carbonates. Electron microprobe analyses returned apatite hosting between 260 ppm and 10 wt.% light REE, and up to 1.7 wt.% heavy REE. Rare earth element X-ray maps suggest that heavy REE-bearing hydrothermal events were distinct from more generalized light REE-bearing hydrothermal fluids. Upcoming laser ablation ICP-MS should help define potential enrichments of critical REE in apatite from specific lithologies.