Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.5035

Assessing the rare metals potential of the Entia Pegmatite Field, Central Australia

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Rare metals, including Rare Earth Elements (REE) are crucial for the transition to a low-carbon society. The concentration of incompatible elements is the result of a long process of crustal differentiation after several orogenic cycles involving partial melting. However, the processes leading to their concentration into economic deposits are still poorly understood. Primary deposits for REE resources worldwide are mainly located in carbonatites and alkaline igneous rocks. But pegmatites and their hydrothermal expression located within metamorphic terranes are also important reserves. An example for this type is the recently discovered Nolans Bore deposit in Central Australia. In the same area, other REE-bearing pegmatites have been identified at the Entia Pegmatite Field (EPF) in the Hart Ranges as well.

In order to better understand the mechanisms that create REE deposits in a metamorphic context and evaluate the EPF's potential, a field campaign was conducted to sample pegmatites and their host rocks. These pegmatites cross cut the orthogneisses from the Entia metamorphic dome, that was formed during the Alice Springs Orogeny. The detailed petrological, mineralogical and geochemical analysis we have performed highlights the presence of at least four different type of pegmatites : i) allanite-bearing, in a submillimetric to aplitic quartzo-feldspathic matrix ; ii) amphibole-pyroxene-plagioclase-bearing, with a large variability in grain size, from plurimetric to submillimetric but usually foliated; iii) Garnet-bearing, associated to K-feldspar and quartz crystals ranging from multimillimetric to sub-decimetric sizes, with rare white micas, oxides and apatite ; iv) K-feldspar-micas-bearing that can be divided into sub-groups with different K-feldspar modal abundance and the presence of additional minerals locally (micas, oxydes, monazite, apatite...), grain size ranging from plurimillimetric to centimetric. Finally, we propose a model in which orogenic processes play a key role on the formation of this large range of pegmatite types within the same poly-metamorphic terrane.