

## **NEW INSIGHTS INTO THE REE MINERALISATION OF THE FEN COMPLEX, NORWAY**

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The ~580 Ma Fen Complex in southern Norway consists of an igneous carbonatite-ijolite-pyroxenite rock suite and is considered to be one of the largest REE resources in Europe with an estimated reserve of >100 MT ore with ~0.9 wt% REE-oxide. The hydrothermally altered rock Rødbergite shows the highest concentration of REE within the Fen Complex. Rødbergite is a calcite-dolomite carbonatite, which is stained red by disseminated fine crystals of hematite [1]. The geological mechanisms which caused the formation of the REE mineralisation in the Rødbergite are poorly understood. Here we provide new geochemical and mineralogical analyses to fill this gap and deliver exploration companies with a precise and detailed ore formation model.

We identified and systematically sampled key transects in the Fen Complex that record the transformation from a primary carbonatite to a hydrothermally altered Rødbergite. Mineral identification and textural analysis of the samples was carried out using scanning electron microscopy, and the bulk composition of the samples was analysed by a combination of XRF and ICP-MS.

We present textural evidence for the breakdown of primary REE-fluorocarbonates and the precipitation of secondary monazite-(Ce), which requires the mobilisation of REE during the alteration of carbonatite to Rødbergite. The progressive hydrothermal alteration is associated with a 10-fold enrichment of REE in Rødbergite with up to 16000 ppm TREE [2]. The difference in stability and mobility for LREE, HREE and Th during the hydrothermal alteration caused the formation of distinct enrichment zones for these elements along the alteration transect. The presentation will explain the zonation and highlight the importance of two petrological features which are associated with the REE mineralisation: The density of monazite-(Ce) and allanite veining and the occurrence of apatite relics in Rødbergite. These apatite relics are acting as a trap for monazite-(Ce) precipitation and therefore play an important part in the enrichment of REE.

[1] Andersen (1984) *Lithos* **17**: 227-245. [2] Marien et al. (2017) *MinMag* (submitted).