

THE OTANMÄKI REE MINERALIZATION (FINLAND) – A POTENTIAL SOURCE OF CRITICAL ELEMENTS IN EUROPE

Kärenlampi K.*¹, Paulick H.¹, Hanski E.¹, Kontinen A.² & Jylänki J.³

¹ Oulu Mining School, University of Oulu, Finland

² Geological Survey of Finland, Kuopio, Finland

³ Otanmäki Mine Oy, Oulu, Finland

Corresponding email: kimmo.karenlampi@oulu.fi

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The Otanmäki area in central Finland contains promising rare earth element and niobium mineralization. Although discovered already in 1982, the genesis of the mineralization remains poorly understood. A PhD project on the deposit started at the University of Oulu in January 2016 with the aims to generate a geological and mineralogical characterization of the deposit in order to elucidate the mineralization processes and to study the beneficiation properties of the REE minerals. Here we report results from ongoing studies on drill cores and outcrops.

The bedrock of the Otanmäki area is dominated by ca. 2.05 Ga, fine- to coarse-grained, peralkaline to peraluminous A-type granites (the Otanmäki Granite Suite; OGS). It is bordered by Archaean TTG-gneisses to the north, south and west. To the east, it is in contact with the metasedimentary rocks of the Paleoproterozoic Kainuu Schist Belt and is also intruded by ca. 1.80 Ga granite-pegmatite dykes. The OGS forms a 65-km-long and 1- to 8-km-wide, boomerang-shaped body showing a moderate to strong deformation related to the ca. 1.8-1.9 Ga Svecofennian orogeny.

The Nb-REE mineralization is located in the western part of the OGS, where alkali-amphibole±alkali-pyroxene bearing granites are dominant. The immediate wall rock suite to the Nb-REE mineralization consists of quartz-feldspar gneisses and associated interlayers of amphibolites and mica-schists. During the drilling campaigns in 1981-1985, two separate mineralizations were outlined: Katajakangas (Ka) and Kontioaho (Ko). Both form shallow dipping, concordant layers with sharp contacts to the quartz-feldspar gneisses that reach several hundreds of meters in strike length and extend to depths of at least 150-200 m. These layers are 0.2-1.4 m (Ka) and 7-12 m (Ko) thick and contain the following REE minerals: allanite-(Ce) $[(\text{Ce,Ca,Y})_2(\text{Al,Fe}^{3+})_3(\text{SiO}_4)_3(\text{OH})]$, bastnäsite-(Y) $[(\text{Y,Ce})\text{CO}_3\text{F}]$, a columbite-group mineral $[(\text{Fe,Mn})(\text{Nb,Ta})_2\text{O}_6]$, and fergusonite-(Y) $[\text{Y}(\text{Nb,Ta})\text{O}_4]$, together with zircon $[\text{ZrSiO}_4]$ and thorite $[(\text{Th,U})\text{SiO}_4]$. Representative sections show 1.0-2.5 wt.% ZrO_2 , 0.1-1.0 wt.% Nb_2O_5 , and 0.5-3.6 wt.% TREO at Katajakangas, and 1.4-6.3 wt.% ZrO_2 , 0.05-0.3 wt.% Nb_2O_5 , 0.3-2.1 wt.% TREO at Kontioaho.

During the PhD project, geological data from field and drill core investigations will be integrated with detailed mineralogical, geochemical and isotope data, in order to evaluate the genetic relationship between the Otanmäki Nb-REE mineralization and the peralkaline OGS, and the role of later thermal and tectonic events. Furthermore, the suite of quartz-feldspar gneisses associated with the mineralization will be dated (U-Pb *in-situ* zircon) in order to determine the temporal and genetic relationships to the 2.05 Ga OGS. The ultimate goal of the project is to assess the possibilities of economic utilization of the Nb-REE mineralization and to enhance the potential to discover new similar occurrences, and hence to strengthen the high-tech metal self-sufficiency of Finland and Europe.