

Chemical evolution of the Luumäki gem beryl pegmatite: Constraints from EPMA and LA-ICPMS mineral composition data

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Granitic pegmatites are important hosts for economically important rare-element and gemstone deposits, but the magmatic and hydrothermal processes responsible for enrichment of rare-elements and formation of gem-bearing miarolitic pockets are not fully understood.

The Luumäki gem beryl-bearing pegmatite is located within the Wiborg batholith in SE Finland, about 20 km SW of the town of Lappeenranta. It consists of at least two exposed pegmatitic dikes, and one is being actively mined for yellow gem beryl (heliodor) by the Karelia Beryl Oy company. The pegmatite shows a well-developed zoning with border zone, wall zone, intermediate zone and quartz core (Lahti and Kinnunen, 1993). This magmatic crystallization sequence is followed by miarolitic pockets, which contain euhedral crystal assemblage (smoky quartz, K-feldspar, biotite, gem beryl). The mineralogy of the different pegmatite zones has been characterized, including determination of the accessory minerals.

Key minerals (feldspars, micas, fluorite and quartz) have been studied for their chemical composition (electron-microprobe and LA-ICPMS analysis of major and trace elements) to reconstruct the compositional zoning and time-space evolution of the Luumäki pegmatite system. Fluorite REE data suggest that both exposed dikes are part of the same pegmatite system, but only one carries economic gem beryl mineralization. The feldspar trace element data suggest that the formation of beryl bearing miarolitic pockets was caused by exsolution of Be enriched hydrothermal fluids during the late stage of pegmatite formation.

The textural relations between the pegmatite border zone and the host rock rapakivi granite demonstrate that the pegmatite was emplaced while the rapakivi granite was still hot and partially molten. Ongoing studies focus on stable isotope geochemistry, fluid inclusion studies and trace element modeling. This aims at reconstructing the pressure-temperature conditions and chemical environment during formation of gem beryl pocket.

References:

Lahti, S. and Kinnunen, K., 1993. A new gem beryl locality: Luumäki, Finland. *Gems & Gemology* 29, 30-37.