Lithium-Caesium-Tantalum pegmatites in the Varuträsk area: Source, transport, trap.

Joel BH Andersson[a], Edward P Lynch[ab], Martiya Sadeghi[b], and Tobias E Bauer[a]

[a]Division of Geosciences and Environmental Engineering, Luleå University of Technology, 971 87 Luleå, Sweden; joel.bh.andersson@ltu.se. [b]Department of Mineral Resources, Geological Survey of Sweden, P.O. Box 670, 751 28 Uppsala, Sweden, martiya.sadeghi@sgu.se

The Varuträsk pegmatite is the most extensively studied pegmatite in the Fennoscandian shield (e.g. Quensel 1956) but the broader mineralized system in the Varuträsk area (source-transport-trap) remain unresolved. The Varuträsk pegmatite has been suggested to belong to the c. 1.8 Ga S-type Skellefte granite suite (Kathol & Weihed 2005) but geochronological data (c.f. Romer & Wright 1992, Weihed et al. 2002) indicate a potential need for a more nuanced understanding regarding the direct genetic relationship between the Skellefte-suite and the LCT-pegmatites of the area. As part of the Horizon Europe project Exploration Information System (Grant agreement n°1010557357 – HORIZON-CL4-2021-RESILIENCE-01), we present lithogeochemistry data from various granitoid rock types to explore potential sources of the LCT pegmatites in the region, and we employ structural-lithological mapping and uniaxial compressive strengths (UCS) data of host rocks to probe their transport and controls on entrapment style.

Lithogeochemistry results indicate a continuum between small and elongated bodies of texturally intensely varying pegmatitic-aplitic to equigranular variants of the Skellefte suite and the LCT pegmatites. However, equigranular to porphyritic variants of the Skellefte suite that form plutons and have a higher biotite and lower silica content tend to plot separately on both major- and immobile trace element plots. This indicates that some parts of the Skellefte suite were more fertile than others and possibly derived from slightly different sedimentary protoliths at different stages of the convergent margin evolution, but we stress the need for modern geochronological data to better constrain the granitoids and the pegmatites in time. Nevertheless, a revaluation of the Skellefte suite concept might be necessary to understand the details of the LCT pegmatite mineralized system in this part of the Bothnian Basin.

Mapping data indicate fluid-melt transport mainly occurred along pre-existing structures as veins and dykes of several generations increase in the vicinity of the structures. In general, anatectic veins are folded or boudinaged along the main fabric and these veins are crosscut by undeformed quartz veins at an angle to the fabric, thus indicating early migmatization progressing to hydrothermal processes through lowered P-T conditions with time.

Entrapment styles are always brittle in character and pegmatites are bounded by fracture planes. UCS data on host rocks to pegmatites indicate the competence of host rocks as one key parameter controlling the dip of the pegmatite emplacement. Higher Mpa values favour shallower pegmatite orientations and interestingly, shallow orientations are also restricted to the Varuträsk (and Åkerberg included for comparison) pegmatites that are the most evolved examples in this study. The mechanics of pegmatite emplacement should not be overlooked when mineral system approaches are applied since shallow geometries may allow for more time for vertical pegmatite differentiation and most world class LCT pegmatite deposits show shallow or sub-horizontal dips (Groves et al. 2022).

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