

# Mineralogical characterization of a Li-phosphate-bearing pegmatite dyke from the Arlanda area, central Sweden

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During an ongoing investigation of potential arsenic-bearing lithologies in the Arlanda area different rocks including granitic pegmatites have been recorded. Granitic pegmatite swarms varying from simple ceramic to highly fractionated and mineralogically complex types occur at the western margin of the Vallentuna granitic massif close to Arlanda airport (Nysten & Jonsson 1998). These dikes belong to the LCT-family of the rare-element class of Cerny (1991). Here a moderately fractionated dyke containing grey microcline, white plagioclase (cleavelandite), muscovite, apatite, beryl, garnet, Mn-(Fe)-Al phosphate, and columbite – tantalite is described.

## Geological setting

Thin pegmatite swarms intruding epiblastic Precambrian rocks parallel to their foliation planes occur close to Starrmossen. A local concentration of pale green phosphate pods up to 20 mm in size with a blue alteration rim has been identified using pXRD at Museum of Natural History in Stockholm as triphylite. These pods are set in a matrix of albitic plagioclase, dark grey to black quartz and white muscovite (SWEREF 6612622/665685). No clear zonation has been recorded but bands rich in red garnet are present. Accessory white beryl and dark green to blue apatite also occur. A prominent feature is the presence of light blue vivianite at the triphylite rims. Traces of other phosphates form small euhedral brownish-yellow crystals in vuggy parts of phosphate pods. Columbite *sensu lato* associated with bituminous U-oxides up to a few mm in size is relatively common. Arsenic phases (arsenopyrite/löllingite) occur sporadically in analogous dikes to the south of the pegmatite described above and schorl is a common mineral in many of these rocks.

## Mineral chemistry

Manganiferous apatite ( $\text{Ca}_{4.41}\text{Mn}_{0.27}\text{Fe}_{0.02}\text{Na}_{0.01}\text{P}_{2.92}\text{F}_{0.99}\text{Cl}_{0.01}\text{O}_{12}$ ) has been recorded as well as a hydrated MnAl-phosphate which is sensitive to the electron beam and showing a low total. A several mm large euhedral platy columbite – tantalite overgrowing cleavelanditic albite shows intricate oscillatory rhythmic growth zonation with  $\text{Mn}/(\text{Mn}+\text{Fe}) = 0.44$  and  $\text{Nb} > \text{Ta}$  for both light and dark BSE zones. This pattern is cut by a late interfingered columbite phase with minor Ti and  $\text{Mn}/(\text{Mn}+\text{Fe}) = 0.29$ . Small euhedral columbite – tantalite shows Nb-rich cores (ferrocolumbite) and Ta-rich rims (ferrotantalite/ferrotapiolite) suggesting a crystal fractionation trend. The columbites occur both disseminated in the pegmatite matrix as well as inclusions within garnet. A Fe-rich chlorite + quartz form rims on the columbite crystals. Garnet composition varies from core–mantle–rim as Alm 52.2 – 53.7 – 61.4 Sps 47.0 – 45.5 – 37.4 with minor pyrope and grossular components. The increase in almandine towards the rim is probably a metamorphic feature.

## Genetical considerations

Fractional crystallization from a fertile granitic source such as the Vallentuna granite (Nysten 2022) is suggested, which would fit into a regional distribution pattern of earlier recorded dikes at Arlanda.

## References

- Cerny, P., 1991: Rare-element pegmatites. Part 1: Anatomy and evolution of pegmatite deposits. *Geoscience Canada* 18, 49-67.
- Nysten, P. & Jonsson, E., 1998: Mineralogy of a late Svecofennian Granitic Pegmatite, Norrskogen, Uppland, Sweden. 17th General meeting of the International Mineralogical Association, Toronto, Canada A150.
- Nysten, P., 2022: Preliminary report on a moderately fractionated rare-element pegmatite at Långåsen, Arlanda, Sweden.