Li-aluminosilicate Textures in Li-rich Pegmatites from Barroso-Alvão, Northern Portugal

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Summary

The Barroso-Alvão (BA) pegmatite field is located in the Iberian Peninsula, the most westerly portion of Europe. The main hosts for the pegmatites of the BA pegmatite field are meta-pelitic, mica-shists, and rarely carbonaceous or graphitic schists of upper Ordovician to lower Devonian age. The region was affected by three phases of the Hercynian orogeny originating S_1, S_2 and S_3 foliations observed in the field. The study area has experienced intense and widespread granitic plutonism and metamorphism. The region hosting the BA pegmatite field also contains numerous different types of granitic rocks classified as Syn-D_3 granitoids and late to post tectonic granitoids (Post-D_3), according with their relation to the Hercynian orogeny. Based on field observation, mineralogy, emplacement of the bodies, and geochemical data, there were identified six different groups in the BA pegmatite field. In this study we will only focus two different types of the Li-rich pegmatite bodies: i) spodumene pegmatites with major quartz, feldspar, spodumene, muscovite, and minor Nb-Ta minerals, Mn-Fe-Li phosphates, along with other accessory mineral phases; ii) petalite pegmatites with quartz, feldspar, petalite, muscovite, and minor cassiterite, Nb-Ta minerals, Mn-Fe-Li-Ca-Al-Ce-U phosphates, among other accessory phases.

In the spodumene pegmatites, spodumene is the dominant Li-bearing mineral. Spodumene occurs in three petrographic varieties: 1) Primary poikilitic crystals with irregular shape and containing sparse blebs of quartz. Accessory eucryptite is found in the fractures of spodumene crystals; 2) Matted aggregates of very fine-grained needles preferentially oriented surrounding earlier coarser-grained spodumene; 3) Intimate intergrowth of spodumene and petalite in a banded sequence. Petalite occurs in two petrographic varieties: 1) Surrounding spodumene, with eucryptite in their fractures, but not replacing it along fractures or twin planes; 2) Euhedral to subhedral crystals of primary petalite.

In the petalite pegmatites, petalite is the dominant Li-bearing mineral. Petalite exhibits a euhedral to subhedral form, perfect cleavage (001) and it occurs as isolated or agglomerated grains. It is frequently fractured and a pale brownish aggregate of fine-grained eucryptite fills in mineral fractures. SQUI is observed in the border zone, and in the centre of petalite crystals, interpreted as a pseudomorphic replacement in weakness points. Spodumene occurs in two petrographic varieties: 1) Centimetre size and it is considered primary. It forms euhedral to subhedral colourless crystals, tabular to {100} and elongated in the direction of [001] with perfect cleavage parallel to {110}; 2) Millimetre size crystals forming matted aggregates of very fine-grained needles that contours petalite, and feldspar, or overlaps aggregates of coarser spodumene and quartz. This spodumene is interpreted as a result of a late D_3 ductile shear zone.

According to the petrogenetic grid for Li-aluminosilicates, the existence of spodumene, petalite and eucryptite are a function of pressure and temperature. The existence of so many peculiar micro-textures in the Li-bearing pegmatites from Barroso-Alvão suggests a variation of the range of pressure and/or temperature during pegmatite emplacement and evolution.