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Spodumene and Quartz Intergrowth – Textural and Genesis Point of View

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The observation of spodumene quartz intergrowth both in the field and in microscopy is a common texture found in Lithium-rich pegmatites from different parts around the world. However, this texture may result from different environments of formation, it may be a primary texture or a secondary texture resultant from secondary reactions or posterior deformation. This study will approach the meaning of these terminologies and how different types of spodumene and quartz intergrowth can have similar textures but completely different conditions of formation.
The amazing variety of textures and crystal morphologies in pegmatites are related to the crystal growth rate and to the degree of undercooling of the pegmatitic melt (the difference between the liquidus temperature and the actual temperature of the magma) resultant from non-equilibrium kinetic factors (Vernon, 2004; Webber and Simmons, 2007; London, 2008). The fact that pegmatites with symplectites of SQI originated from petalite seems to indicate that the rock after being solid still had some time at an elevated temperature to try to re-equilibrate its mineral phases while cooling down, indicating a low-to-moderate degree of undercooling. Another indication for its relatively low degree of undercooling is the lack of abundant textures reflecting a high degree of undercooling, such as skeletal, and radial crystals morphologies.
Several aplite-pegmatite veins of the Barroso-Alvão pegmatitic field are deformed by D3 and can be found in linear or echelon regional structures which seems to indicate that they were emplaced during a ductile to brittle late-D3 phase, still affected by the reminiscences of the heat resultant from the emplacement of the surrounding peraluminous syn-tectonic granites (Noronha et al., 2006). Fine-grained needles of spodumene and quartz intergrowth are observed in some aplite-pegmatites veins in Barroso-Alvão filling intergranular spaces and fractures between feldspars, quartz and petalite. This type of spodumene seems to be formed due to a pressure increase, maybe caused by shearzones, related to the D3 phase (Charoy et al., 1992; Martins, 2009). The dissolution of petalite would have occurred at its contact points with other minerals and then precipitated in intergranular spaces as spodumene + quartz intergrowth. These spaces would be filled with a metamorphic intergranular fluid (maybe groundwater since this would already be a shallow system), resulting in a more compressed rock. For example, at a depth of 10 km and T around 300°C, it is normal for the minerals to start to dissolve and the motion of these fluids could transport several chemical species, and since Li and H_2O are, for example, fluxing elements, they would help keeping the fluid from being reabsorbed rapidly. However, if a substantial chemical change accompanies metamorphism the process is already called metasomatism, and in this case the fluids mentioned could already be fluids released from a melt (Winter, 2014).
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