

Phosphate mineral associations in the Cañada pegmatite (Salamanca, Spain): Paragenetic relationships, chemical compositions, and implications for pegmatite evolution

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ABSTRACT

The Cañada pegmatite (Salamanca, Spain), a Li-P-(Sn-Nb ± Ta)-bearing granitic pegmatite, is intruded partly into a gabbro and partly into a leucogranite. Three phosphate associations have been distinguished, based on paragenesis, texture, and chemistry: (1) ferrisicklerite-magniotriplite-johnsomervilleite association (in the border zone), in which Mg-bearing phosphates and coexisting Fe-Mg silicates are abundant; (2) ferrisicklerite-graftonite association (in the transition zone) characterized by higher values of Fe/(Fe + Mg) than in the border zone; and (3) triphylite-sarcopside association (in an inner zone), which also includes minor montebrasite, ferrocolumbite, and cassiterite, typical of an evolved pegmatite facies. As a result of the decrease of Mg, the Fe/(Fe + Mg) ratios for phosphates, biotite, and tourmaline increase from the border to the inner association (e.g., for ferrisicklerite and graftonite, from 0.67 and 0.85 in the border to 0.94 and 0.98 in the inner association, respectively). This difference is particularly evident for biotite and tourmaline; for example, the Fe/(Fe + Mg) ratios for tourmaline range from 0.59 in the border to 0.86 in the inner zone. These variations seem to reflect contamination of marginal zones of the pegmatite by some type of reaction with the host gabbro. Thus, an evolutionary trend involving inward crystallization from the margins and contamination of fluids from wallrocks into pegmatite-forming melt may be a plausible genetic model. The occurrence of phosphates along with Fe-Mg silicates would indicate that the melt contained on the order of 1.3–2.4 wt% P₂O₅, based on experimental silicate-phosphate equilibria.