Wyllieite reaction coronas on scorzalite in pegmatite dykes

Dias P[1], Leal Gomes C[1], Guimarães F[2], Hatert F[3*]

1 - CIG-R, Univ. Minho, Portugal 2 - LNEG, S. Mamede de Infesta, Portugal

3 - University of Liège *fhatert@ulg.ac.be

In the region of Serra de Arga (Northern Portugal) pegmatite dykes with approximately 50 cm thick and 2 m long, affected by Variscan deformation, contain scorzalite that is partially replaced by wyllieite reaction coronas. Mineral composition of the dykes consists of quartz, albite, K-feldspar and muscovite. Accessory minerals include andalusite, Mn-rich fluorapatite, columbite-(Fe), gahnite, uraninite, montebrasite and brazilianite [1].

Scorzalite occur as disseminated bluish to greenish single crystals up to 3 mm in size (Figure 1a). Inclusions of muscovite, gahnite and montebrasite (?) were identified. Scorzalite often displays complex alteration patterns corresponding to the development of brownish Al-Fe-Mn rich products (childrenite-eosphorite?). Other breakdown products include associations of crandallite-goyazite and variscite. Scorzalite electron-microprobe analysis showed the following average composition: $(Fe^{2+}_{0.90}Mg_{0.05\text{-}0.07}Mn_{0.02}Zn_{0.0\text{-}0.01})_{a0.95\text{-}1.01}Al_{2.0\text{-}2.1}(PO_4)_2(OH)_2$.

Wyllieite forms light blue corona-like overgrowths around primary scorzalite and also penetrate along fracture fillings of the scorzalite crystals, as revealed by transmitted light microscopy (TLM) and EMP study (Figure 1b). Electron-microprobe analysis provided P_2O_5 = 45.5-47.2; Al_2O_3 = 8-8.6, MnO = 15.2-16.3, FeO = 23.5-24.6%, MgO = 0.44-0.54; Na_2O = 4.2-5.3 wt. %. The resulting formula, calculated on the basis of 12 O, is $(Na_{0.64\text{-}0.79}Ca_{0.02\text{-}0.03}Mn_{0.30\text{-}0.39})_{a=1.01\text{-}1.22}(Mn_{0.60\text{-}0.71}Fe^{2+}_{0.29\text{-}0.40})_{a=1}(Fe^{2+}_{0.27\text{-}0.61}Fe^{3+}_{0.34\text{-}0.67}Mg_{0.05\text{-}0.06})_{a=1}(Al_{0.72\text{-}0.77}Fe^{3+}_{0.23\text{-}0.28})_{a=1}(PO_4)_3$. Some of these compositions correspond to wyllieite, while oxidized grains correspond to rosemaryite [2].

Such unusual previously undescribed scorzalite breakdown was caused by post-magmatic, Na bearing fluids interacting with the pegmatite. Na could have become available by feldspar breakdown. Both albite and K-feldspar occur in the matrix and reflect distinct high phosphorous contents. K-feldspar contains up to 3.6 wt% of P_2O_5 and coexisting albite up to 1.98 wt%. Distribution of P between Fk and Ab ($P_{Fk/Ab}$) is 1.8. Textural relationships indicate albitization of the K-feldspar.

According to [2], wyllieite could have formed at temperatures lower than 400°C, considering a pressure of 0.1Kbar. These estimates are within the considered field for scorzalite collapse (475-560°C, 1-3Kbar) [3].

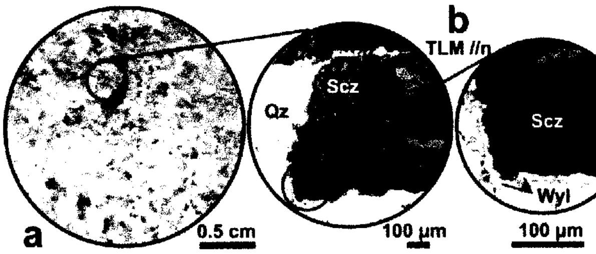

Figure 1: Scorzalite-wyllieite representative intergrowths.

[1] Dias (2012.) Ph.D Thesis, Univ. Minho, *464p.*

[2] Hatert F. *et al.* (2006). *Eur. J. Mineral.*, 18, 775-785.

[3] Schmid-Beurmann *et al.* (2000). *Miner. Petrol.*, 70, 55-7.

Fe, Mg and Mn distribution among tourmaline, micas and phosphates from the Tres Arroyos granitic pegmatites (Central Iberian Zone, Badajoz, Spain)

Garate-Olave I, Roda-Robles M E*, Gil-Crespo P, Pesquera A

UPV/EHU *encar.roda@ehu.es

The Tres Arroyos pegmatite field is located southeast from the Nisa-Alburquerque pluton (Central Iberian Zone, Badajoz, Spain). This is a late Variscan body composed of peraluminous monzogranites and leucogranites, with associated pegmatitic and aplitic dykes, which intrude into metamorphic rocks from the Schist-Greywacke Complex of Upper Precambrian to Lower Cambrian age. Pegmatites are classified into three different groups according to their texture, mineral association and spatial distribution. The bodies occurring closest to the pluton show the less evolved facies, with feldspars, quartz and muscovite as main constituents, and zinnwaldite, tourmaline, topaz and Fe-Mn phosphates as common accessories. In an intermediate area some albite-rich dikes occur, where K-feldspar, quartz and micas are also abundant, whereas fine-grained topaz and montebrasite crystals occur as accessory phases. The third group, in the furthest areas from the pluton, are Li-rich dikes, with albite, K-feldspar, quartz and lepidolite as the main constituents, and montebrasite, cassiterite, topaz and columbite-group minerals as minor phases.

Fe±Mg±Mn-bearing minerals have only been found in the first group of pegmatites. Zinnwaldite occurs as fine-grained flakes, with a slight pleochroism from colourless to light beige. Chemically, crystals are quite heterogeneous, with a broad range for FeO (5.96-12.66 wt%) and smaller for F (2.11-4.48 wt%). Muscovite shows negligible amounts of both Fe and Mg. Tourmaline appears as small black prismatic crystals that under the microscope show different shades of brown, frequently displaying a concentric colour zoning. However, all tourmaline crystals analyzed up to now correspond to quite homogeneous, Mg-poor schorl. The Fe-Mn phosphates identified are ferrisicklerite, eosphorite-childrenite, jahnsite, rockbridgeite and lipscombite. All of them occur as fine-grained crystals, scattered among the silicates. Jahnsite and lipscombite replace partly or completely the ferrisicklerite. Most of these phosphates belong to the Fe-rich term of their Fe-Mn series, with Fe/(Fe+Mn) ratios of 0.88-0.89 for ferrisicklerite, 0.67-0.82 for jahnsite, and 0.91-0.98 for lipscombite and rockbridgeite. Eosphorite is the only phosphate richer in Mn than in Fe, with ratios in the range 0.38-0.62. As it is expected in this pegmatitic environment, the studied minerals are Mg-poor, with the exception of the Mg-jahnsite (5.75-8.00 wt% MgO). The rest of the minerals show pretty low contents in Mg (<0.72, <0.29 and <0.14 wt% for phosphates, micas and tourmaline, respectively). In general, tourmaline is richer in Fe and poorer in Mg and Mn than zinnwaldite, whereas Mn preferentially partitions into the phosphates (up to 4.25wt% for lipscombite and rockbridgeite, up to 5.23wt% for ferrisicklerite, up to 1.80wt% for jahnsite, and up to 18.04wt% for eosphorite).

The pegmatites associated with the Fe±Mg±Mn-bearing minerals show moderate levels of fractionation, with a relative enrichment in F, Li and Na. The scarcity of Fe-Mg-Mn-bearing minerals indicates a very low content in Mg, Fe and Mn at the beginning of crystallization of the dykes of the first group. The lack of ferro-magnesian-(manganoan) phases in the other two groups of dykes in Tres Arroyos, suggests that these elements were mainly consumed during the crystallization of the dykes closest to the batholith. There, Mn partitions preferentially into the phosphates, whereas tourmaline is the Fe-richest phase and zinnwaldite shows, in general, the highest contents in Mg and higher values in Mn than the tourmaline.