Wyllieite reaction coronas on scorzalite in pegmatite dykes

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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 (**Fig. 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: $(Fe^{2+}_{0.90}Mg_{0.05\text{-}0.07}Mn_{0.02}Zn_{0.0\text{-}0.01})_{\Sigma 0.95\text{-}1.01}Al_{2.0\text{-}2.1}(PO_4)_2(OH)_2$.

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 (**Fig. 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 $(Na_{0.64\text{-}0.79}Ca_{0.02\text{-}0.03}Mn_{0.30\text{-}0.39})_{\Sigma 1.01\text{-}1.22}$ $(Mn_{0.60\text{-}0.71}Fe^{2+}_{0.29\text{-}0.40})_{\Sigma=1}(Fe^{2+}_{0.27\text{-}0.61}Fe^{3+}_{0.34\text{-}0.67}Mg_{0.05\text{-}0.06})_{\Sigma=1}(Al_{0.72\text{-}0.77}Fe^{3+}_{0.23\text{-}0.28})_{\Sigma=1}(PO_4)_3$. 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 400ºC, considering a pressure of 0.1Kbar. These estimates are within the considered field for scorzalite collapse (475-560ºC, 1-3Kbar) **[3]**.

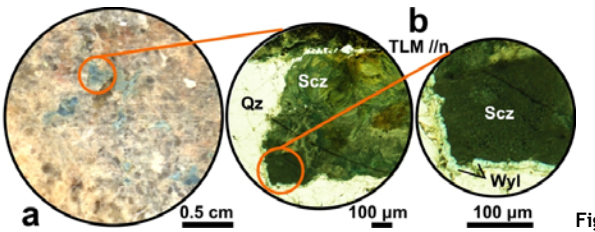

Fig.1- Scorzalite-wyllieite representative intergrowths.

[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.