Tourmalines from exocontact and endocontact zones from the Manjaka pegmatite, Sahatany Valley, Madagascar

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TUR2021 3rd International Conference on Tourmaline

INTRODUCTION

Tourmalines are indicators of a variety of geological processes due to their ability to incorporate large number of elements and refractory behaviour. They are highly compatible with Mg; hence, they are used as monitors of external contamination in granitic pegmatites from host rocks (e.g., Novák 2013; Novák et al. 2017).

GEOLOGY AND MINERALOGY

The Manjaka pegmatite is an excellent example of pegmatite where tourmalines are locally developed in the exocontact and endocontact of the pegmatite enclosed in calc-silicate rock. The pegmatite forms an EW-trending elongated body, 0.5 to 2 m thick, of a complicated shape (Fig. 1a). Typical major to minor minerals include albite > K-feldspar, quartz, tourmaline (black, brown, yellow, red, pink), and spodumene (colorless to pinkish; localy replaced by boralsilite and/or vránaite, Cempírek et al. 2016) and numerous accessory minerals e.g., fluorapatite, Cs-rich beryl, columbite-tantalite, pollucite, rhodizite-londonite; however, micas are almost absent (Simmons et al. 2001, Novák et al.2013). Pegmatite crosscut or was emplaced along the foliation (Fig. 1a) of a strongly deformed, Mg-rich, calc-silicate rock consisting of diopside(Di_{94-100} Hd_{0-4} Jhs_{0-4}), plagioclase (An_{26-32}), K-feldspar (Kfs_{73-96} Ab_{1-10} Cls_{0-26}), phlogopite, tremolite, dolomite, quartz, and tourmaline. Contacts are often sharp; locally a narrow zone with common dark zoned brown to yellow tourmaline (Ca-rich dravite to Na-rich uvite), is developed in exocontact (Fig. 1b,2a,b) as subhedral grains, 0.1-0.2 mm in size, in the matrix consisting of diopside, plagioclase, K-feldspar, phlogopite, tremolite, and rare dolomite. Prismatic yellow to red zoned crystals (elbaite to fluor-elbaite), up to ~1 cm long, crystallized from contact inwards.

Fig. 1

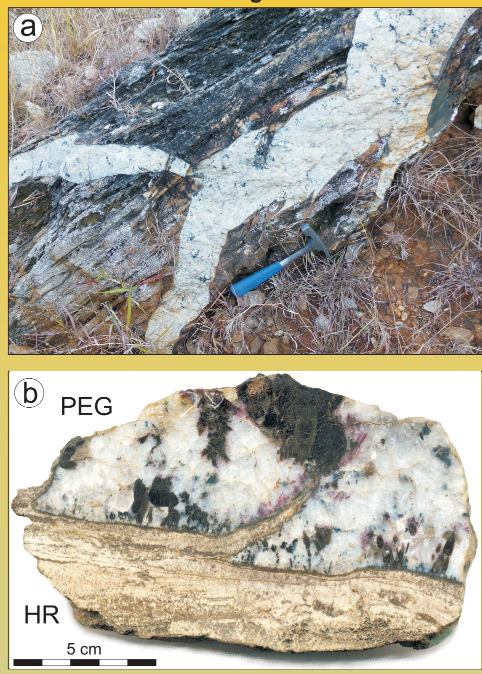
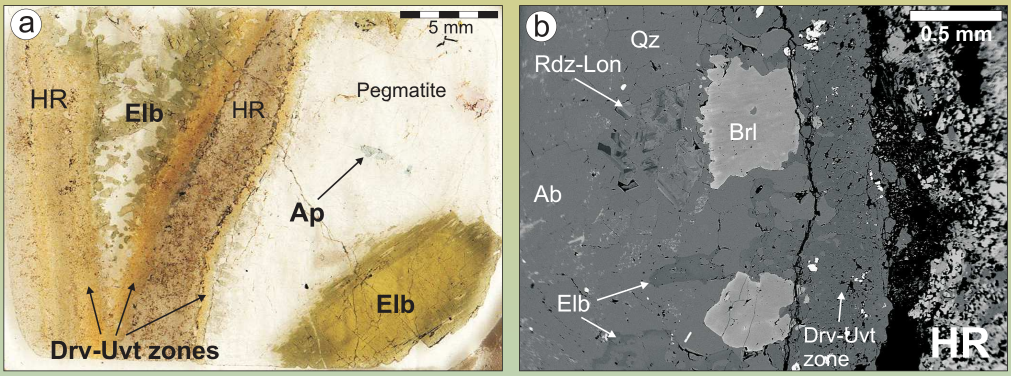
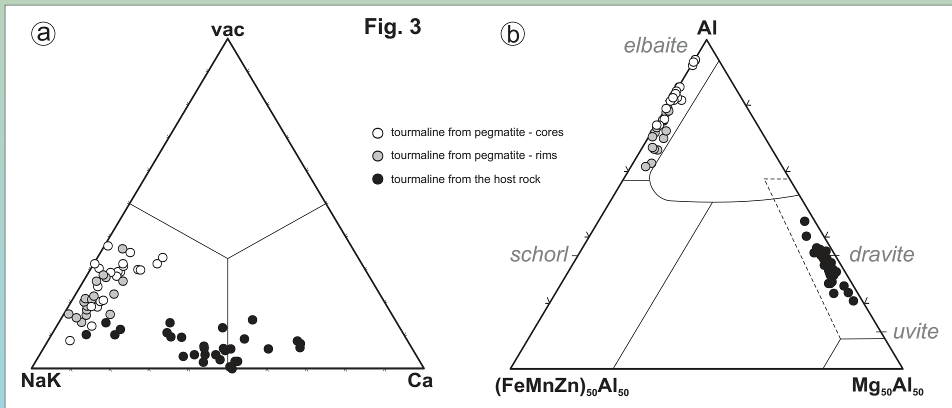


Fig. 2



TOURMALINES

We examined tourmalines on two profiles from endocontact to exocontact. Chemical composition of tourmaline in Fig. 3 shows that tourmaline from endocontact evolves from Fe,Mn-rich elbaite core with low Mg (< 0.19 apfu) to Mg-free elbaite to fluor-elbaite in rim. Both tourmalines have low to moderate Ca (< 0.17 apfu). Heterogeneous grains of uvite-dravite from exocontact contain variable Ca (0.09-0.65 apfu) and Na (0.26-0.805 apfu) but almost constant and high Mg (2.28-3.28 apfu). The substitutions $2R^{2+}$ = LiAl and NaAl = CaMg dominate in endocontact- and exocontact-tourmalines, respectively. Common tourmaline in exocontact and accessory minerals (e.g., Cs-beryl, microlite, Ta-rich titanite) show that fluids rich in B, Ta, Be, Cs escaped from pegmatite melt and facilitated origin of the exocontact assemblage with dominant newly formed tourmaline. Low concentrations of Mg in cores of zoned elbaite crystals show low Mg in the pegmatite melt which likely was not contaminated from host rock in situ during pegmatite melt emplacement. Magnesium in tourmaline from endocontact was likely sourced during early contamination - pre-emplacement stage as well as Ca in core and rim (see Novák 2013).



REFERENCES

Cempírek J., Grew E.S., Kampf A.R., Chi Ma, Novák M. Gadas P., Škoda R., Vašinová-Galiová M., Pezzotta F., Groat L.A. & Krivovichev S.V. 2016 Vránaite, ideally $Al_{16}B_4Si_4O_{38}$, a new mineral related to boralsilite, $Al_{16}B_6Si_2O_{37}$, from the Manjaka pegmatite, Sahatany Valley, Madagascar. American Mineralogist, 101, 2108-2117.

Henry D.J. & Guidotti C.V. 1985 Tourmaline as a petrogenetic ndicator mineral - an example from the staurolite-grade metapelites of NW Maine: American Mineralogist, 70, 115.

Novák M. 2013 Contamination processes in complex granitic pegmatites. Conference PEG 2013, 100-103.

Novák M., Gadas P., Vašinová-Galiová M., & Pezzotta F. 2013 Compositional variations in Cs,Li,Mg-rich beryl from exocontact of the complex Manjaka pegmatite, Sahatany Valley, Madagascar. PEG 2013.

Novák M., Prokop J., Losos Z. & Macek I. 2017 Tourmaline, an indicator of external Mg-contamination of granitic pegmatites from host serpentinite; examples from the Molda nubian Zone, Czech Republic. Mineralogy and Petrology, 111, 625-641.

Simmons W.B., Pezzotta F., Falster A.U. & Weber K.L. 2001 Londonite, a new mineral species: the Cs- dominant analogue of rhodizite from Antadrokomby granitic pegmatite, Madagascar. Canadian Mineralogist, 39, 747-755.