GRANITIC PEGMATITES OF THE TŘEBÍČ SYENITE PLUTON, MOLDANUBIAN ZONE, CZECH REPUBLIC; AN EXAMPLE OF NYF TO MIXED PEGMATITES RELATED TO THE OROGENIC PLUTON

ŠKODA, R.* & NOVÁK, M.
Institute of Geological Sciences, Masaryk University, Kotlářská 2, CZ-611 37 Brno, Czech Republic
* E-mail: rskoda@sci.muni.cz

The current petrogenetic classification of granitic pegmatites includes two main petrogenetic families – orogenic LCT (enriched in lithium + cesium + tantalum) and anorogenic NYF (enriched in niobium + yttrium + fluorine). Several pegmatites share MIXED geochemical and mineralogical characteristics; however, their geotectonic position is not commonly discussed (ČERNÝ & ERCIT, 2005).

A large tabular body of the Třebíč Pluton (TP; ~540 km^2) is emplaced in medium- to high-grade metamorphic rocks of the Gföhl unit in the eastern part of the Moldanubian Zone. Porphyric (orthoclase), amphibole-biotite melasyenite to quartz melasyenite and melagranite show metaluminous composition (ASI = 0.85–0.93) with high concentrations of K_2O (5.2–6.5 wt%), MgO (3.3–10.4 wt%), P, Rb, Ba, U, Th, Cr, Cs, but unusually low Ca and Sr. Geochemical signature as well as isotopic Sr ($^{87}Sr/^{86}Sr_{337}$ = 0.709–0.7125) and Nd (εNd_{337} = -6.3) data suggest mixing of mantle-derived durbachite magma with (leuco)granitic melt derived from crustal rocks undergoing anatexis during rapid decompression (e.g., ŽÁK *et al.*, 2005).

The TP is characterized by abundant intragranitic NYF pegmatites with common biotite, tourmaline, titanite, allanite-(Ce) and Y,REE,Nb,Ta,Ti-oxides. The pegmatites have been divided on three distinct varieties: (i) Subhomogeneous allanite-type pegmatites forming small irregular nests and segregations commonly with transitional contact to the host syenogranite. (ii) Lenses, dikes and irregular bodies of simply zoned euxenite-type pegmatites (with Y,REE,Nb,Ta,Ti-oxides), are up to 2 m thick and several meters long, with transitional to sharp contacts. Typical minor to subordinate minerals include biotite (X_{Mg} = 0.49–0.70), black tourmaline (Ca,Ti-rich dravite-schorl to schorl) and a wide spectrum of accessory minerals present mainly in euxenite-type pegmatites, i.e. aeschynite- and euxenite-group minerals, allanite-(Ce), ilmenite, titanite, (Na,Cs,Mg,Fe,Sc)-enriched beryl, phenakite, niobian rutile, pyrite, and zircon. (iii) The euxenite-type pegmatite Klučov I with aeschynite-group minerals exhibits very similar geological position, internal structure and mineralogy. However, it is characterized by a higher degree of fractionation manifested by more abundant B-bearing minerals, chemical composition of tourmaline and presence of Sn-bearing (cassiterite, herzenbergite) and B-bearing (tinzenite) minerals relative to the other euxenite-type pegmatites. Low contents of P_2O_5 in feldspars as well as scarcity of phosphates (apatite, monazite) in pegmatites are typical.

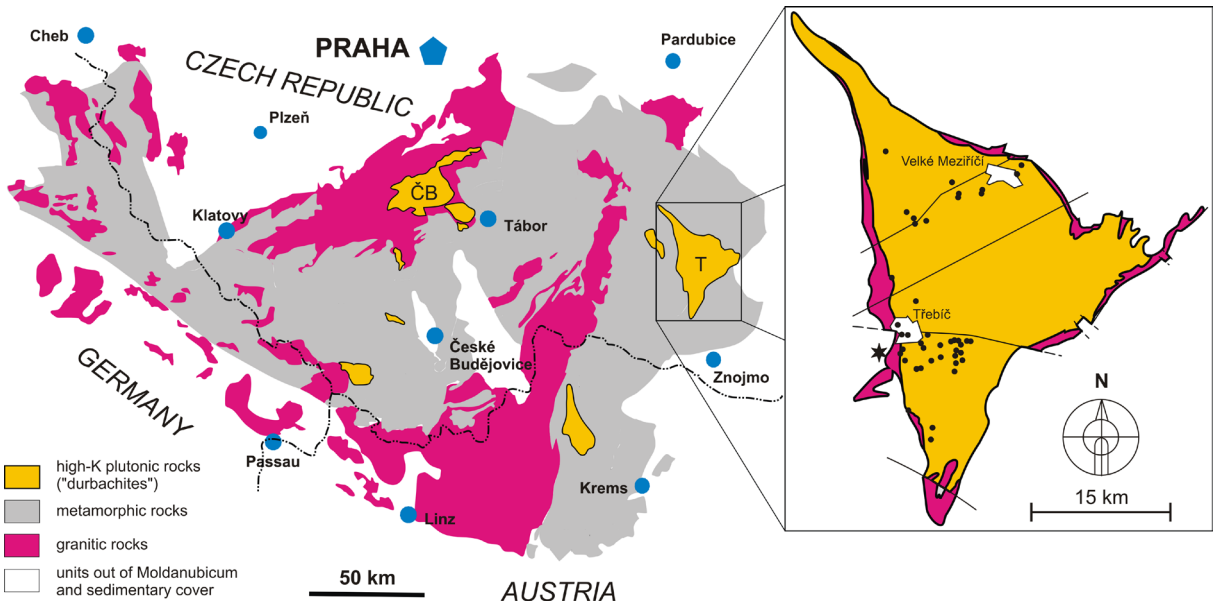

Fig. 1. *Schematic geological map of the part of Moldanubian zone (left) and Třebíč Pluton (right) including pegmatite districts; dots = NYF pegmatite occurrences, star = Kracovice MIXED pegmatite. In part modified from NOVÁK et al. (2012).*

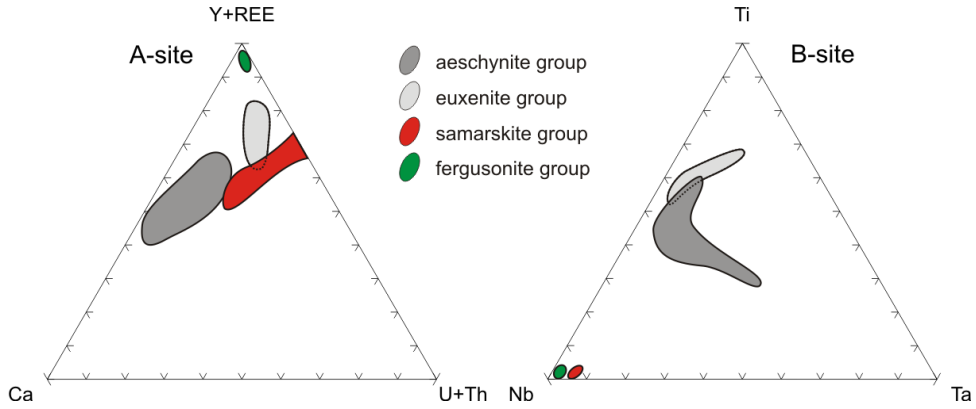

Fig. 2. *Chemical composition of aeschynite-, euxenite-, samarskite-group minerals and fergusonite (A-site and B-site occupancy). In part modified from ŠKODA & NOVÁK (2007).*

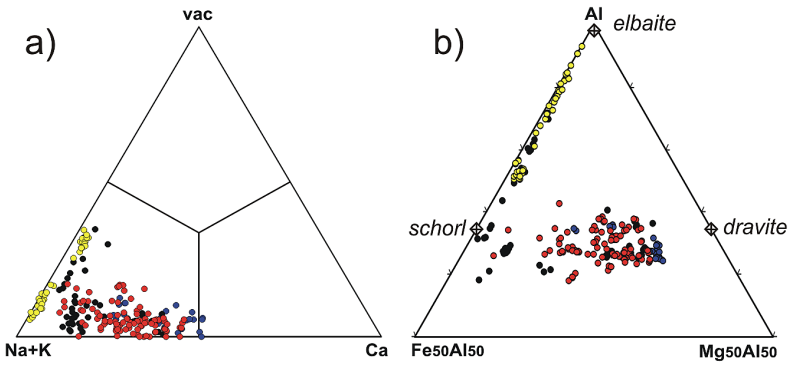

Fig. 3. *Composition of tourmaline from allanite-type pegmatites = blue symbol, euxenite-type pegmatites = red symbol, pegmatite Klučov I = black symbol, pegmatite Kracovice = yellow symbol: a) Na+K–Ca–X-site vacancy triangle; b) Fe_{tot}–Mg–Al triangle (NOVÁK et al., 2012)*

The most evolved lithium-bearing Kracovice pegmatite forms symmetrically zoned dike, about 1 m thick and 30 m long, which cuts graphitic gneiss located about 300 m from the edge of the TP. The most differentiated part of pegmatite consists inwards of: a granitic unit (Kfs + Plg + Qtz + Bi + Msc), graphic unit (Kfs + Qtz ± Bi) evolving to minor blocky K-feldspar, and albite complex situated close to small quartz core. Major minerals are represented by quartz, K-feldspar (locally amazonite) and albite (saccharoidal and rare *cleavelandite*). Typical subordinate minerals include micas (muscovite, biotite, zinnwaldite, masutomilite, polylithionite), tourmalines (schorl, elbaite); topaz, Y-rich spessartine, F-rich hambergite, monazite-(Ce), xenotime-(Y), zircon (Zr/Hf = 20.1–5.8), fergusonite-(Y), samarskite-(Y), calciosamarskite, hinnganite-(Y), columbite-(Mn), wolframoixiolite (MnNb >> FeTa), pyrochlore-(Y), titanite, cassiterite, scheelite, beryl, fluorite and löllingite. Close spatial, geochemical and mineralogical relations of this pegmatite to the intragranitic NYF pegmatites of the Třebíč Pluton suggest them to be a single pegmatite population (NOVÁK *et al.*, 2012).

The Třebíč Pluton is evidently orogenic body, which intruded to mid-crustal levels (at ~343–335 Ma) shortly after exhumation of the host high-grade rocks of the Gföhl unit. Apparent (geochemical and mineralogical) NYF signature of the itragranitic pegmatites (disregarding high Mg/Fe in minerals and low activity of F, typical for pristine anorogenic NYF pegmatites) is in contrast with the orogenic origin of the parental granite. The pegmatite from Kracovice with the MIXED signature, a member of the same granite-pegmatite system, confirms a strange character of this unique granite-pegmatite system of the Třebíč Pluton – orogenic with NYF > MIXED signature.

References

ČERNÝ, P. & ERCIT, T.S. (2005): Canadian Mineralogist, 43: 2005–2026.

NOVÁK, M., ŠKODA, R., GADAS, P., KRMÍČEK, L. & ČERNÝ, P. (2012): Canadian Mineralogist, 50: in print.

ŠKODA, R. & NOVÁK, M. (2007): Lithos, 95: 43–57.

ŽÁK, J., HOLUB, F.V. & VERNER, K. (2005): International Journal of Earth Sciences, 94: 385–400.