Abyssal pegmatites in Moldanubicum of the Bohemian Massif

JAN CEMPÍREK[1,2] & MILAN NOVÁK[2]

[1]Department of Mineralogy and Petrography, Moravian Museum, Brno, Czech Republic; jcempirek@mzm.cz
[2]Department of Geological Sciences, Masaryk University, Brno, Czech Republic

ABSTRACT

Abyssal pegmatites are common constituents of high-grade rocks in the Moldanubicum, Bohemian Massif. They typically occur in high-grade metamorphic rocks of upper amphibolite to granulite facies with HP metamorphic conditions and low MP overprint. Their mineral assemblages are mostly simple and peraluminous, with kyanite/andalusite, Al-rich tourmaline and dumortierite as typical accessories. Mineralogy of typical AB-BBe-subclass abyssal pegmatites from Starkoč and Běstvina is briefly reported.

Keywords: *granitic pegmatites, HP metamorphism, beryllium, boron, Moldanubicum.*

INTRODUCTION

Abyssal (metamorphic) pegmatites are related to anatectic processes in high-grade metamorphic rocks of upper amphibolite to granulite facies. Their mineral assemblages are mostly simple, including common rock-forming minerals such as muscovite, biotite, garnet, tourmaline, cordierite and Al_2SiO_5 modifications besides major minerals - quartz, plagioclase and/or K-feldspar. Usually, they form dikes, lenses or irregular bodies commonly about several cm to several dm thick, hosted largely in metapelitic rocks. Their internal structure is commonly simple, complexly zoned pegmatites are rare.

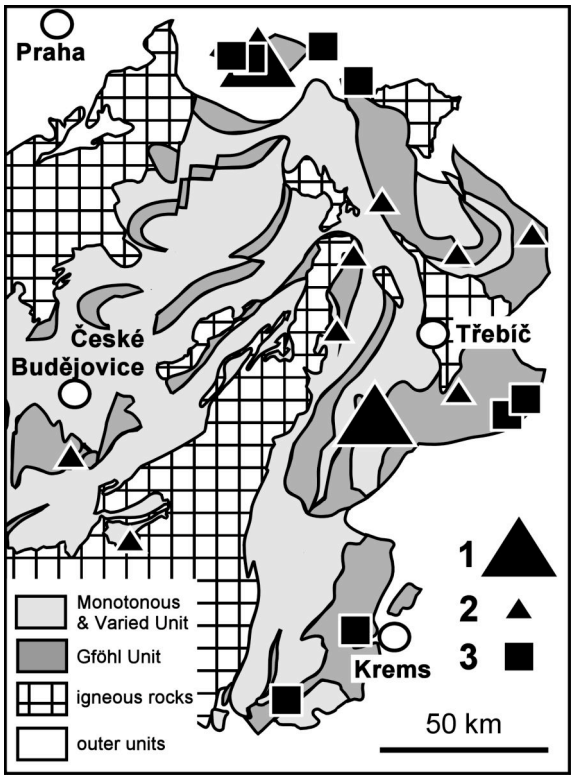

FIGURE 1. Occurrences of dumortierite in central and eastern part of Moldanubicum. 1 - major occurrences in boron-bearing granulites and migmatites, 2 - rare occurrences in granulites, migmatites and gneisses, 3 - occurrences in abyssal pegmatites.

Occurrences of various abyssal pegmatites were reported from Antarctica, Madagascar, Sri Lanka (e.g. Grew et al. 1995, 1998, 2000), Norway (Huijismans et al. 1982), Zambia (Žáček & Vrána 2002) and other regions. However, compared to their magmatic relatives, abyssal pegmatites including AB-BBe subclass have been less commonly object of mineralogical and petrological studies (see e.g. Černý & Ercit 2005; Martin & De Vito 2005).

MAJOR OCURRENCES OF ABYSSAL PEGMATITES IN THE BOHEMIAN MASSIF

In the Bohemian Massif, common abyssal pegmatites of AB-BBe subclass occur in high-grade metamorphic rocks along the easternmost border of Moldanubicum (Fig. 1). They are characterized by the presence of B-rich and/or Be-bearing minerals such as Al-rich tourmalines, dumortierite and rare chrysoberyl.

Pegmatite host rocks exhibit HP (± UHP) metamorphic conditions with low degree of MP overprint, hence rapid uplift is typical. Migmatization is common, pegmatite host rocks also locally exhibit elevated contents of B and As, marked by presence of tourmaline, dumortierite and arsenopyrite. Random occurrences of dumortierite in high-grade rocks confirm the elevated contents of B within the whole unit (Fig. 1).

CASE STUDY: MINERALOGY OF STARKOČ PEGMATITE

Abyssal pegmatites from Starkoč and Běstvina are typical examples of the AB-BBe subclass pegmatites in the Bohemian Massif. The features typical for origin and evolution of both abyssal pegmatites are better preserved at Starkoč. Based on the paragenetic relationships, three distinct assemblages were recognized: (i) Primary igneous assemblage: plagioclase I + quartz I + muscovite + garnet + tourmaline I + dumortierite I + chrysoberyl; (ii) Prograde metamorphic assemblage: quartz II + plagioclase II + kyanite + K-feldspar + staurolite + tourmaline II + dumortierite II; (iii) Retrograde metamorphic assemblage: pyrophyllite and kaolinite. Plagioclase, quartz and muscovite are major minerals in the pegmatite veinlet; the most common accessory minerals include tourmaline, dumortierite, garnet, K-feldspar and kyanite, whereas only low amounts of chrysoberyl, staurolite and few rare accessory minerals (fluorapatite, monazite-(Ce), xenotime-(Y), löllingite) were found.

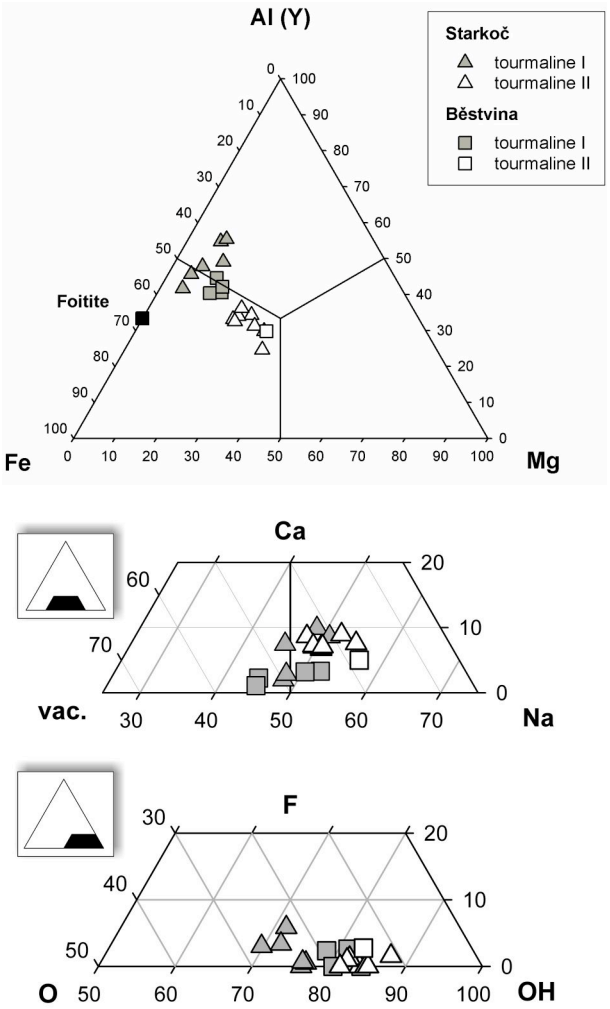

FIGURE 2. Starkoč and Běstvina tourmaline composition. A – Y site, B – X site, C – V+W sites.

Composition of accessory tourmaline (Fig. 2) is controlled by the two-stage evolution of the pegmatite. Primary tourmaline I from Starkoč is typical by its high Al-content and incorporation of Al into the T-site. It exhibits crystallization trend expressed by the substitution $(^{Y,Z}Al\ ^{T}Al)\ (^{Y,Z}R^{2+}\ ^{T}Si^{4+})_{-1}$. Prograde metamorphic event, which partially transformed muscovite + plagioclase into kyanite + K-feldspar + quartz (Fig. 3), introduced additional Fe and Mg from the host rock into the system and remobilization of B allowed crystallization of Mg-enriched, rather homogeneous tourmaline II with stoichiometric Si content in T-site. Although the partitioning of OH between V- and W-sites is not precisely known, it is clear that tourmaline I shows a significant fraction of "oxy-tourmaline" end-member(s), whereas tourmaline II contains higher amount of OH in both sites. The elevated content of Al in T-site is a typical feature of tourmaline from abyssal pegmatites (e.g. Cempírek 2003, Cempírek et al. 2006, Cempírek & Novák, 2006).

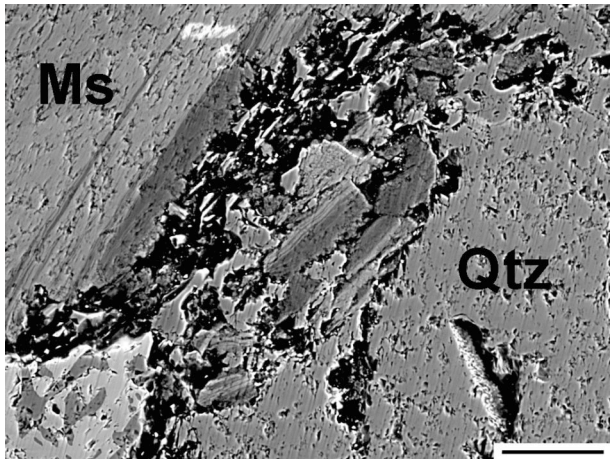

FIGURE 3. Fine-grained aggregate of kyanite + quartz II + plagioclase II + K-feldspar, within altered rim of muscovite crystal, at the contact with quartz I. Spotty light grain at the bottom left is staurolite with inclusions of quartz II. Darker rim of muscovite is formed by pyrophyllite. Scale bar is 0.05 mm.

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