Highly Fractionated, Garnet-bearing Granites from the Brno Massif

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Three distinct suites of granitic rocks – Rena, Tetčice and Hlína – have been recognized in the western part of the Brno massif (BM). The Rena suite builds up the southernmost part of the BM and consisits of I-type, felsic (SiO_2 > 69 wt.%), coarse-grained, amphibole-, biotite-bearing granodiorite locally grading to biotite-bearing granite and leucogranite. The Tetčice suite separated from the Rena suite by the so-called Ivančice tectonic line (Leichmann 1996, Mittrenga et al. 1976) consists of two main types of plutonic rocks: S-type, fine-grained, biotite-bearing granodiorites and amphibole-bearing diorites as xenoliths in granitoids. Besides diorite, granites host a broad spectrum of mostly metasedimentary enclaves (gneiss, calc-silicate rocks and rare marbles).

The Hlína suite is represented by irregular intrusions and dykes of felsic (SiO_2 > 75 wt.%), K-rich, fine-grained, garnet- and/or biotite-bearing granites. Some dykes grade into a coarse-grained facies in their central parts. Relatively large intrusions were found only within the Tetčice suite, dykes occur in both the Rena and Tetčice suite. Several metres wide alteration zones, marked by reddish haloes, are developed along the contact between dykes and surrounding rocks.

The Hlína granite consists of anhedral quartz (26–35 vol.%), subhedral, zoned (core - An_{15}, rim - An_8) plagioclase (25–30 %) and sub- to anhedral K-feldspar (35–41%). Minor to accessory minerals include biotite (0.5–5 %), garnet (~1%), magnetite, primary epidote, zircon, secondary muscovite (1–2%) and chlorite (< 1%). Relative to the other granites from the BM, K-feldspars are depleted in Na_2O (0.27–0.32 wt. %) and Ba-poor, whole rock analyses yielded 17–74 ppm Ba. Oscillatory-zoned spessartine-almandine is a typical accessory mineral: Sps_{48-46}, Alm_{36-35}, And_{12-11}, Grs_{7-4}, Prp_{4-1}. The most prominent feature is the high concentration of yttrium (≤ 2.16 wt. % Y_2O_3) in the rim. Negative correlation of Y to Ca and Al and positive correlation to Mg, Mn and Fe indicate substitution mechanism apparently different from $Y^{3+}Al^{3+} \rightarrow Mn^{2+}Si^{4+}$ found in Y-rich garnets (Wakita et al. 1969).

A felsic nature of the rock is reflected in high SiO_2 (75.3 to 76.4 wt .%), K_2O (4.11–4.19 %), Na_2O (3.54–4.02 %) and low FeO (0.48–0.73%), MgO (0.04–0.05%), CaO (0.81–0.89 %) and TiO_2 (below detection limit); elevated contents of MnO (0.11–0.12 %) and high content of Y (52 - 60 ppm) correspond with their high concentrations in garnet. The Nb (31 - 46 ppm) and Rb (154–331 ppm) concentrations are increased, Zr (85–119 ppm), Sr (24–30 ppm) and Ba (17–74 ppm) contents are decreased relative to the BM granitoids. The presence of primary epidote and low A.S.I. (1.07–1.08), disregarding high SiO_2 contents, indicate an I-type affinity of the Hlína suite. The granites plot, based on their high concentrations of Y, Nb and Rb, in the field of within-plate granites (Pearce 1996). High degree of fractionation is also marked by very low Mg/Fe (0.05–0.14) and K/Rb (225–103) ratios. Widespread alteration along the contact of dykes indicates that granite melt was volatiles-oversaturated, however, it does not necessarily mean that the melt was oversaturated through the whole crystallization, and, similarly, locally observed pegmatitic structures are not a direct evidence of melt oversaturation.

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