Granodiorite Porphyries of the Moldanubian Zone - Evidence for the Beginning of post-Variscan Extension

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Variscan post-orogenic granites of the Moldanubian zone of the Bohemian Massif are most frequently considered to be the product of anatexis of upper-crust sediments. Emplacement of the main body of the Central Moldanubian batholith (South Bohemian batholith) was followed by the emplacement of small bodies of muscovite granites and of acid and intermediate to basic dyke rocks. In the Moldanubian zone intermediate to basic dyke rocks represented by granodiorite, tonalite and gabbro porphyries, occasionally also by lamprophyres, fill disjunctive structures of different orientations, often paralleling those of the fold axes of metamorphosed series of the Moldanubian zone. Intermediate to basic dyke rocks were formerly considered to be the products of fractionation of a granite melt (Fuchs and Thiele 1968); according to Němec (1975) they were derived from an independent lamprophyre or tholeiitic melt. The dykes on the northeastern margin of the Klenov massif represent a special group of granodiorite porphyry dykes. It occurs as en-echelon developed, NE-SW- trending dykes filling disjunctive structures oblique to younger, NNE-SSW- or N-S- trending shear structures. The disjunctive structures used by granodiorite porphyries for their emplacement are parallel to the fold axes and the porphyries penetrate in several cases older aplite-granite dykes. The age of the granodiorite porphyries can be derived from that of the Eisgarn-type granites and from the age of formation of the N-S-trending shear structures. A critical analysis of dating of the Eisgarn s.l.- type granites yielded a value for their Rb-Sr age of 330±6.5 Ma, in the case of the youngest vein granites the Rb-Sr age is 318±3 Ma. Cooling ages based on ^{40}Ar–^{39}Ar for the central part of the Eisgarn s.l.-type granite body are 313–308 Ma (Scharbert 1998). The age of formation of the N-S-trending shear zones is, according to the dating also based on ^{40}Ar–^{39}Ar, 281.3±0.6 Ma (Brandmayr et al. 1995). These data enable to estimate the time of formation of the granodiorite-porphyry dykes at 308 to 281 Ma. Higher age of the granodiorite porphyries than that of the N-S-trending shear structures is confirmed by horizontal displacement of a granodiorite porphyry dyke recorded on a N-S-trending shear zone filled by uranium mineralization.

Granodiorite porphyries from the northeastern margin of the Klenov massif are fine-grained, black to grey-black rocks with aphanitic texture of the matrix. The matrix often contains plagioclase phenocrysts, several mm, sometimes up to 1 cm in size. The phenocrysts are often zoned, with a basic core (An_{54}) and an acid margin (An_{14}). The matrix is predominantly composed of plagioclase (An_{25-50}), with subordinate amounts of K-feldspar and quartz. Dark minerals, often chloritized, are represented by pyroxene (augite) and biotite (Fe/(Fe + Mg) = 0.66–0.72). Amphibole (cummingtonite) occurs rarely. Accessory minerals are represented by very abundant sphene, less abundantly by allanite, apatite, rutile and zircon. Ilmenite occurs rarely, being usually replaced by sphene. Granodiorite porphyries from the NE margin of the Klenov massif have a metaaluminous character and a higher proportion of TiO_2 (1.85–1.95 wt.%). With respect to the trace-element content these porphyries are characterized by high Ba/Rb ratio and by a relatively higher proportion of transitional elements, particularly of vanadium. The REE content is markedly higher than usual in similar rocks of the Moldanubian zone, the presence of a negative Eu anomaly (Eu/Eu* = 0.77) and a higher proportion of HREE are characteristic. Allanite is the most important carrier of REE, higher content of HREE is probably controlled by the bond of HREE to pyroxene. Granodiorite porphyries are characterized by a relatively low proportion of mg values, by the absence of normative olivine and higher proportion of normative diopside, which indicates that they were generated by an advanced differentiation of a tholeiitic magma. The magma of granodiorite porphyries of the Moldanubian zone was, according to Gerdes (1977), separated from a hydrated lithospheric mantle as a result of thickening of the crust and due to an intensive melting of deeper parts of the crust and of the crust/mantle boundary. The presented work has been completed thanks to financial support of the Grant Agency of the Czech Republic (Project No. 205/97/0514).

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