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Tourmaline-Bearing Leucogranites from the Třebíč Pluton in the Moldanubicum

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Peraluminous leucogranites with accessory tourmaline derived from crustal sources are widespread in mountain belts formed by continental collision (London et al., 1996). In eastern part of the Moldanubicum they are spatially associated with the Třebíč pluton, and three distinct types of leucocratic, medium- to fine-grained, biotite and muscovite-biotite granites with accessory tourmaline were distinguished.

(i) Two mica granites with tourmaline concentrated in orbicules (OTG) compose small intrusive bodies and dykes, scarcely up to 200 m thick. Quartz + tourmaline ± feldspars orbicules, up to 10 cm in diameter, or rare veins, up to 2 cm thick, are randomly distributed or concentrated in several m thick zones within bodies of leucocratic granites. Subhedral tourmaline is interstitial between euhedral grains of feldspars and quartz, and it replaces dominantly plagioclase. The accessory minerals include apatite, andalusite, cordierite, ilmenite, zircon, allanite, xenotime and monazite in granite; apatite is fairly abundant in orbicules. The tourmaline-quartz orbicules and veins seem to be a product of crystallization of evolved, B-rich medium (melt and/or fluid) during late solidus to early subsolidus stage of the granite formation.

(ii) Two mica granites with disseminated tourmaline (DTG) form relatively large intrusive bodies and dykes, up to several km². They do not exhibit such apparent spatial relationship to durbachite plutons as OTG. Euhedral to subhedral tourmaline grains, up to several mm long, are rather regularly distributed in the rock. The accessory minerals include apatite and zircon. In contrast to the OTG, disseminated tourmaline crystallized from granitic melt.

(iii) Biotite granites with tourmaline (MTG) typically occur in marginal zone of the Třebíč pluton. They form relatively small bodies (up to several hundred m thick) and are associated with migmatites and aplites. Euhedral tourmaline grains occur in coarse-grained pegmatoid facies, subhedral interstitial grains in rare quartz + tourmaline ± feldspars orbicules, up to 5 cm in diameter. Poikilitic garnet forms grains from 5 to 25 mm in diameter, randomly distributed in the rock, further accessory minerals include apatite, zircon and sillimanite.

All types of tourmaline granites have very similar geochemical signature corresponding to leucocratic and

peraluminous (ASI = 1.0–1.3), syn- to post-collisional S-type granites: K₂O = 2.77–6.14; Fe₂O₃tot = 0.42–2.08; Rb = 194–234 ppm; Mg/Fe = 0.08–0.33; Rb/Sr = 1.00–5.56 in OTG, 5.24–7.34 in DTG and 0.5 in MTG; CaO = 0.49–0.87, 0.36–0.66 and 1.67, respectively. The normalized REE patterns are very similar for OTG and DTG granites; low REE concentrations (ΣREE = 20.08–99.81 ppm and slight LREE enrichment (LaN/LuN = 1.9–6.8). The MTG indicate HREE depletion (LaN/LuN = 10.14) with distinct positive europium anomaly (Eu/Eu* 2.5). Similar mineral assemblages, whole rock major, minor and trace chemistry suggest that positive and negative europium anomalies (Eu/Eu* 0.5–1.6) found in both OTG and DTG rather reflect different fO₂ during crystallization. Lower CaO/Na₂O ratios (0.10–0.22) in OTG and DTG are typical for melts derived from clay-rich, plagioclase-poor pelitic rocks (Sylvester, 1998). The high CaO/Na₂O ratios (0.53) in MTG are typical for melts generated from plagioclase-rich psammitic rocks.

The zircon saturation temperatures 784–725 °C obtained for durbachitic rocks in Třebíč pluton (Watson and Harrison, 1983) are similar to those the MTG (778 °C); DTG and OTG provided 660–713 °C, and 660–746 °C, respectively.

The geochemical signatures suggest relatively primitive character of all granite types. The OTG and DTG had similar protoliths (metapelites) and conditions of melting (probably muscovite dehydration melting). Geochemical and mineralogical signatures of MTG exhibit less primitive character and higher temperature of melting (probably biotite dehydration melting).

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