Geochemistry and Petrogenesis of Granulites in the Lišov Granulite Massif, Moldanubian Zone in Southern Bohemia

Stanislav VRÁNA and Vojtěch JANOUŠEK

Czech Geological Survey, Klárov 3, 118 21 Praha 1, Czech Republic

The Lišov granulite massif (LGM) — the fourth largest body within the South Bohemian granulite complex — shows a number of chemical, petrological and geological differences that discern it from the neighbouring granulite massifs: i) the Al_2SiO_5 minerals, in particular kyanite, are absent in the felsic Grt-bearing granulites (Vrána and Jakeš 1982); ii) the assemblage of Fe-Ti oxides (primary Ti-magnetite + ilmenite) as well as absence of graphite indicate O_2 fugacity higher than that of felsic granulites from the Blanský les massif (ilmenite + graphite + pyrrhotite: Vrána 1992); iii) peridotites as well as pyroxenites are devoid of garnet, eclogites are absent; iv) basic granulites are present in a large volume (> 4 km^2, mainly in the SE part of the LGM). Field relations indicate that many of the basic members corresponded originally to plutonic rocks, contrary to the published suggestion that their parental rocks were basic members of a bimodal volcanic suite (e.g., Fiala et al. 1987).

The present work included five samples (three basic granulites, one Grt + Opx charnockite of granitic composition and one felsic garnetiferous granulite). The samples were analysed for major, minor and trace elements as well as Sr–Nd isotopic composition. Several analyses from Fiala et al. (1987) and unpublished data of Vrána and Jakeš were also used to complement the database, together with three Sr–Nd isotopic ratios obtained by Valbracht et al. (1994) for samples characterized by Fiala *et al.* (1987).

Whole-rock geochemistry. The major-element composition recast to millications (Debon and Le Fort 1988) shows that basic granulites (two-pyroxene types ± Bt, brown Hbl) correspond mainly to quartz diorite with marginal overlap to monzogabbro and gabbro. Felsic granulites (Grt ± Bt) plot in the quartz-rich part of granite and adamellite fields and three samples of intermediate composition straddle a boundary of tonalite, granodiorite and quartz monzonite domains. According to the AFM diagram, the rock compositions correspond to calc-alkaline chemistry. Harker diagrams show negative correlation of SiO_2 with FeO_t, TiO_2, Al_2O_3, MgO, CaO, MnO and P_2O_5, while Na_2O is scattered. Among trace elements, Cr and Sr correlate well with SiO_2 but Rb is characterized by relatively low abundances in both basic and acidic types. Basic granulites have REE patterns with a moderate enrichment in LREE (Ce_N/Yb_N = 3.7–7.9) and relatively minor negative Eu anomalies. Felsic granulites show more prominent negative Eu anomalies and a relative enrichment in HREE (Ce_N/Yb_N = 2.1–2.9) compared to basic samples.

Geochronology, Sr–Nd isotope geochemistry. Geochronology of granulites of the Lišov massif is based on conventional U-Pb dating [341 ± 3 Ma] of equant zircon crystals from two-pyroxene basic granulite at Rudolfov (van Breemen *et al.* 1982) that was interpreted as reflecting the granulite facies crystallization. Comparable granulites of the Blanský les massif, much better studied in terms of U-Pb zircon geochronology, yield ages closely similar to the Rudolfov sample. The available Sr-Nd isotopic data are not sufficient to give protolith ages. However, they do constrain them somewhat and, more importantly, can be used for petrogenetic considerations. The isotopic data plotted in the $^{87}Sr/^{86}Sr_{345}$ vs. ε^{345}_{Nd} diagram form three clusters: 1. relatively primitive basic granulites ($^{87}Sr/^{86}Sr_{345}$ ~ 0.706, ε^{345}_{Nd} ~ -2), 2. more evolved intermediate pyroxene granulites ($^{87}Sr/^{86}Sr_{345}$ ~ 0.708–0.709, ε^{345}_{Nd} ~ -5), 3. felsic Grt ± Bt granulites ($^{87}Sr/^{86}Sr_{345}$ ~ 0.729, ε^{345}_{Nd} ~ -5). Protolith of primitive basic granulites (group 1) could have been generated from a CHUR-like mantle source at ca. 0.5 Ga ago. The existing Sr isotopic data argue against derivation of protolith of the felsic granulites by closed-system fractional crystallization from that of basic granulites. Concerning tentative correlation of basic granulites with amphibolites in the surrounding amphibolite-facies gneissic units, used in several geological interpretations for decades, it can be demonstrated that basic granulites and amphibolites differ significantly — as far as the data are available — in both the whole-rock geochemistry and Sr-Nd isotopic composition.

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