GRANULITES OF THE BOHEMIAN MASSIF: A METAMORPHIC HISTORY

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The Moldanubian zone of the Bohemian Massif is characterized by the presence of high-grade (granulite facies) rocks of the Gföhl nappe which overlie the lower grade gneisses of the Varied and Monotonous series. The granulite facies rocks comprise mostly felsic Grt–Ky granulites, Grt–Opx granulites, Cpx–Opx ± Grt granulites and perpotassic granulites with abundant retrogression features in all lithological types. In addition, the felsic granulites often contain inclusions (blocks 0.X–X00 m in size) of upper mantle rocks (mostly garnet peridotite). The formation of granulite facies rocks in southern Bohemia has originally been explained on the basis of HP–HT metamorphism of a crustal protolith (Fiala et al., 1987). It were mainly the presence of inclusions of mantle rocks in felsic granulites, the presence of magmatic crystallization sequence in the perpotassic granulite (Vrána, 1989), lack of obvious prograde metamorphic P–T path and non-depleted crustal trace element composition which have recently triggered the ideas of the felsic granulite facies rocks representing the high pressure melts (Jakeš & Jelínek, 1997, cf. also Roberts & Finger, 1997). In Lower Austria, similar felsic granulite facies rocks show both prograde and retrograde paths and peak metamorphic conditions of a clockwise P–T–t loop at ca. 16 kbar and 1000 ^{o}C (Carswell & O'Brien, 1993).

Previous attempts to date the protolith formation and the peak P-T conditions using Rb–Sr, Sm–Nd and U–Pb methods have not provided a simple answer, with age in ranges from ca. 720 to 370 Ma and ca. 450 to 340 Ma being interpreted as representing the protolith formation and the metamorphic peak, respectively. Given the uncertainty in the mechanism of granulite formation, the interpretation of geochronological data, unless directly related to a specific mineral growth (cf. Aftalion et al., 1989; Wendt et al., 1994), was usually impossible.

In felsic granulite facies rocks in southern Bohemia, the three deformation stages comprise the formation of anatectic fabric (D1) and a steep N–S trending foliation (D2) overprinted by a flat-laying extensional foliation (D3) which was associated with intrusions of granitoid rocks at ca. 320 Ma and followed by the subsequent emplacement of K-rich syenite (durbachite) masses. New petrological data from the felsic granulites of the Blanský les and Prachatice massifs suggest the presence of a prograde mineral assemblage (biotite and euhedral ternary feldspar) preserved as inclusions in garnet porphyroblasts, similar to those found in rocks from Lower Austria. In addition, field relations in the Blanský les massif point to partial melting and preserved intrusive relations which pre-date the crystallization of kyanite and garnet in the granulites. As at least some of the mantle rocks present within the felsic granulites are deformed by D2 and as their incorporation to the crust was likely to take place during a period of lithospheric extension (Sandiford & Powell, 1984; Vielzeuf & Kornprobst, 1984), they must have been emplaced to the crustal protolith of the granulites, i.e., before ca. 370 Ma. Although the present data suggest a limited formation of melt during D1 (anatexis), D2 (perpotassic high pressure melt) and D3 (granitic magma emplacement), no evidence has been found for the magmatic crystallization of felsic granulites at high pressure conditions.

Age	Metamorphism and magmatism	Deformation phase
370 Ma	Formation of crustal protolith of felsic granulites & emplacement of mantle rocks to the lower crust	
	Partial melting of the protolith and prograde metamorphism	D1 (anatexis/compression)
? – 340 Ma	HP–HT (Ky and Grt crystallization)	D2 (compression)
340 – 320 Ma	LP–HT (decompression mineral reactions)	
? – 320 Ma	LP–HT/MP retrogression and granite emplacement	D3 (extension)
320 Ma	K-rich syenite (durbachite) emplacement	