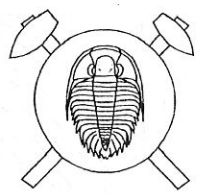
Crystal chemistry of apatite in tourmaline–bearing alkali–feldspar orthogneiss near Hluboká nad Vltavou, southern Bohemia



Krystalochemie apatitu v alkalicko–živcových ortorulách s turmalínem u Hluboké nad Vltavou v jižních Čechách (Czech summary)

(3 text–figs.)

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Accessory fluorapatite from three samples of tourmaline–bearing alkali–feldspar orthogneiss was analyzed by methods of wet analysis; rare earth elements were also determined. MnO contents range from 2.11 to 2.84 wt.%, FeO from 0.86 to 2.38 wt.%, REE oxides from 0.36 to 1.02 wt.%, and Na_2O from 0.54 to 1.20. The chemical composition of apatite including its fluorine content indicates primary magmatic crystallization. The increased contents of Fe, Mn, and REE, and the relative concentrations of Mn – Mg – Fe and La – Ce – Y in these fluorapatites correspond to those of apatites from pegmatites. Apatite is deformed and no post–deformation growth was observed.

Introduction

The existence of several types of substitutions in apatite make this mineral a useful petrogenetic indicator. We turned our attention to the composition of apatite hoping to characterize the mode of origin of its parent orthogneiss.

The orthogneiss north of Hluboká nad Vltavou is a sheet–like body 7 by 2 km in outcrop size, with a true thickness of about 1 km. It is emplaced conformably to semi–conformably in a sillimanite –biotite paragneiss and belongs to the largest of about ten bodies of similar orthogneisses scattered over the Bohemian part of the Moldanubian Zone (Němec 1980, Klečka et al. 1992). The Hluboká orthogneiss was first mapped and studied by Ambrož (1935) and later mapped in detail (Vrána et al. 1980). About sixty orthogneiss samples have been studied in thin sections, twelve samples were analyzed for trace elements (XRF) and two samples were analyzed for major elements. The results show that the Hluboká orthogneiss is a metamorphosed tourmaline–biotite–muscovite alkali–feldspar granite which is remarkably homogeneous throughout the central and western part of the body. It contains no pegmatite dykes and exhibits a composition corresponding to that of a tourmaline pegmatite (Table 1). Following the geochemical study by Slabý (1991), Hluboká orthogneiss can be compared to granites derived from a crustal source in a syncollisional geotectonic setting. Both the REE in orthogneiss (Slabý 1991) and relative concentrations of accessory minerals indicate that apatite is the major REE carrier; monazite and zircon contents are very low.

Several nests of a poorly foliated aplitic rock up to several meters across are known to occur in the uniform orthogneiss, but they have not been studied in detail. Inclusions of two–mica paragneiss mantle rocks are very rare; relicts of former K–feldspar phenocrysts up to 3 cm long are extremely rare. The rock is medium–grained, has a distinct foliation and more or less prominent linear fabric, sometimes accentuated by oriented tourmaline crystals up to 3 cm long.

Samples and methods

Heavy mineral concentrates from three samples, each 30 kg in weight, served for the identification of accessory minerals and for separation of apatite. The localities of the samples are as follows:

#3 roadcut near the road from Hluboká nad Vltavou to Poněšice, near the confluence of Libochovka brook and Vltava,

#30 disused quarry, 700 m ENE of the elevation Velký Kameník (575 m),

#85 outcrop in the saddle between Malý Kameník and Velký Kameník, 250 m NW of the elevation 505 m.

The mineral composition of orthogneisses is shown in Table 2. Apatite, frequently amounting to 1 vol. %, forms equant, anhedral and slightly turbid grains evenly distributed in the rock. Few examples of apatite concentration along certain laminae in the foliated fabric have been noted.

The apatite concentrate is grey–green in colour.