ABSTRACT

The Variscan orogeny occurred during Devonian to Carboniferous convergence between peri-Gondwanan crustal segments and the northern European plate (Baltica). Due to the convergence, Bohemian Massif represents the easternmost and largest exposure in the European Variscan belt. In the southern part of the Bohemian Massif, the Moldanubian Zone consists of several crustal segments with different polyphase tectonometamorphic histories. Moldanubian Zone is considered to represent the Variscan orogenic root, being surrounded by rigid and less metamorphosed blocks to the NW and SE. Structurally highest unit of the Moldanubian Zone is the Gföhl Unit, which is built by heterogeneous assemblage of high-pressure crustal and upper-mantle rocks comprising granulites, peridotites, pyroxenites and eclogites exhumed during Variscan orogeny.

The apatite samples studied in my diploma thesis come from different types of granulites from the Blanský les granulite massif (BLGM) located SW of the town of České Budějovice. BLGM is the largest granulite body of the southern Bohemian Massif, is an integral part of the Gföhl Unit. BLGM consists mainly of calc-alkaline high-pressure felsic garnet ± kyanite granulites, which enclose up to several kilometers long lenses of ultrabasic rocks, numerous boudins of mafic (pyroxene-bearing) granulites and banded garnet-biotite and K-feldspar gneisses, garnet peridotites part and rare small bodies of hyperpotassic granulites with garnet (Plešovice type). Further, the felsic granulites contain deformed discordant leucocratic garnet-K-feldspar layers (dykes) and they are cut by late intrusions of deformed muscovite- and biotite-bearing granites. Along the northern margin of BLGM, a several hundred meters thick body of lithologically varied metasediments containing numerous intercalations of amphibolite, marble and graphitic gneiss is incorporated into GMBL.

The age of granulite-facies metamorphism in the Moldanubian Zone of southern Bohemia is well constrained by number of U-Pb zircon and monazite ages at ca. 340 Ma. This age probably represents HP-HT metamorphism, or alternatively, the age of zircon crystallization from partial melt during decompression along the retrograde P-T path. The age of low pressure-high temperature metamorphism and granite magmatism into granulite is connected with retrogression of granulites at about 320 Ma.

In my study, apatite samples were studied using fission-track method in order to understand the low-temperature history of the granulites-facies rocks in the Moldanubian Zone of the Bohemian Massif. The measured fission-track average cooling ages range from Lower to Upper Jurassic and vary from 186 ± 6.7 Ma to 162 ± 4.9 Ma (1 sigma) for different lithological types of granulites. The apatite fission-track lengths are very homogeneous in all studied samples and range from 10.5 ± 2.2 µm to 12 ± 2.1 µm (1 sigma). All subhorizontal confined track distributions are unimodal with a negative
skewness, interpreted as a result of a slow cooling through the apatite partial annealing zone (PAZ). Apatite fission-track data reflect the low-temperature history of granulites and provide information about the time-temperature conditions in low-temperature stage of their evolution and about the final cooling rate during granulite exhumation. Results obtained by modeling in program HeFty have shown that studied granulites in the annealing zone ca. 125°C were placed in the period ca. 235 - 280 Ma. It corresponds to the depth ca. 4 km. Ever since the slow, stable exhumation took place until the current erosion surface. The initial stages of exhumation calculated on the base of previously published isotopic systems are characterized by high cooling rates of ca. 24 °C/Ma (for HP-HT metamorphism) and subsequently, the rate of cooling slowed down, with an exponential decrease of temperature in the time. The cooling rate of ca. 19 °C progressively decreased to ca. 4 °C/Ma (for LP-HT stage). Using fission-track method, final stage of exhumation of granulites is provided and cooling rate corresponds ca. 0.5 °C/Ma (Mesozoic until recent).