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Geochemical and Isotopic Characteristics of the Granitoids from the Velka Fatra (W-Carpathians) in Combination with U-Pb Ion-Microprobe and TIMS Single Zircon Dating

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The Velka Fatra Mountains belong to the Western Carpathians, and are situated in the central region of Slovakia near the city of Ruzomberok. The Western Carpathians are an important orogenic chain and are often discussed as prolongation of the Alpine chain and/or the Bohemian massif to the east.

The Fatra Mountains are a composite of granitoid plutons, consisting of tonalites, granodiorites, syenogranites and two-mica granites. These rocks were investigated by geochemical, isotopical and geochronological methods.

The results of the major and trace element measurements can be used for the classification of the investigated rocks. Whereas the tonalites and granodiorites are meta-aluminous, the two mica granites appear to be more per-aluminous. According to the classification after Chappell & White (1974) most tonalites and granodiorites are transitional between S- and I-type granitoids. The two mica granites are clearly S-type derived. Further, the geochemical data constrain the Fatra Mountains granites ranging from calc-alkaline arc granites to collisional and post-orogenic ones.

The isotope analyses resulted in $^{87}Sr/^{86}Sr$ present day ratios of 0.708 for the tonalites, 0.709 for the granodiorites and 0.716 to 0.719 for the two mica granites and the orthogneisses. The $\varepsilon_{Nd}(0)$ values vary between -5.4 and -6.5 for the tonalites and -6.6 to -7.7 for the granodiorites and two mica granites. The Nd model ages calculated with the depleted mantle model of Goldstein et al., (1984), reflects the increasing influence of a younger crustal component: the oldest model ages were determined for the orthogneisses (1460 Ma), followed by the two mica granites (1350-1400 Ma) and the granodiorites (1200-1230 Ma). The youngest Nd model ages were found for the tonalites (1150-1200 Ma). All geochemical and isotopical results constrain the dominantly crustal origin of the Fatra granitoids.

Besides these investigations also U-Pb geochronology was done for some of the granitoids. U-Pb single zircon dating by TIMS and ion microprobe analyses were used to get the crystallisation ages. Additionally cathodoluminescence investigations were done to control the internal structures of the analysed zircons. The TIMS dating was performed using the CLC-method (Poller, 2000), the ion microprobe dating was done using the Cameca IMS 1270 at the CNRS of Nancy (France). For the two mica granites a discordia line through several zircons could be drawn with an upper intercept age of 337 ±9 Ma. This age is interpreted as crystallisation of the two mica granites. The tonalites seems to be emplaced later: concordant zircons constrain the crystallisation 304 ±2 Ma ago. Therefore, a multi stage emplacement of the Fatra granitoids, similar to the Tatra Mountains, is inferred by the U-Pb zircon data.

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