PARAGENESIS OF TYPOMORPHIC ACCESSORY MINERALS VS. TYPOLOGY OF GRANITIC ROCKS: EXAMPLES FROM WESTERN CARPATHIANS, SLOVAKIA

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Assemblages of accessory minerals are important criterion for the typological division of granitic rocks. On the example of the West-Carpathian granite suites have been shown that the most critical assemblages for granite classifications are the magmatic accessory paragenesis reflecting the primary character of former melts. The accessory minerals determining the character of primary melts are the typomorphic. Detailed study of accessory minerals in Variscan I- and S-type and post-Variscan Permian specialized S- and A-types granites in Tatric, Veporic and Gemeric Units of the Western Carpathians enable us to characterize their differences and petrogenetic impact to origin of the suites (BROSKA *et al.,* 2011). Primarily relationship between *monazite* and *allanite* is important for the recognition of I- and S-type granitic rocks: monazite-(Ce) dominates in the S-type granites, on the other hand higher water and Ca activities stabilises allanite-(Ce) in the I-type granites. Exceptions represent more fractionated I-type granites where monazite-(Ce) is common. Although monazite-(Ce) in the hypersolvus A-type granites almost absent, in subsolvus granites occurs locally. Except xenotime-(Y), which may locally be abundant in S-type granites, A-type granitic rocks contain further Y-B-silicate phases (gadolinite and hingganite).

Magnetite as a typical mineral of the I-type granitoid paragenesis indicate higher oxidation level. In such rocks Ti-rich magnetite occurs first, which is in late-magmatic stage replaced by nearly pure magnetite in association with titanite. This is interpreted as result of late- to post-magmatic oxidation due to separation of fluid phase and following water dissociation. Another important basis for division is composition of *apatites* (hydroxylapatite to fluorapatite): low contents of Fe and Mn are typical of apatites from I-type granites, in contrast to S-type granite apatites, which are enriched in these elements. Similarly, apatite from A-type granites is commonly rich in Fe. The highest Mn contents accompanied by Sr are found in apatites from specialised S-type granites from the Gemeric unit

Zircon composition and its morphology are the important markers for granite typology. Restite zircon holds many features of former granitic magma. A morphological boundary may be derived from comparison of monazite/allanite antagonistic relationship and zircon morphology based on I.T parameter equal 350; I.T < 350 indicates S-type granites, while I.T > 350 is characteristic of I-type granites, I.A parameter is close to 300 for both granitic types. A higher I.A parameter close to 400 indicates specialised S-type granites. The A-type granites have values in the range 650–700. Hypersolvus granites contain commonly zircon subtypes D and P5 with high I.T parameter around 700, whereas subsolvus A-type granites show lower I.T parameter, close to 300. Orthomagmatic zircons show Zr/Hf_{wt} ratio in S- and I-type granites roughly 35–45, late-magmatic zircons in leucogranites have a lower ratio due to increase of Hf with differentiations. High Zr/Hf_{wt} ratio (> 50), but low Y, REE, U, Th concentrations in early magmatic zircons from hypersolvus A-type granites are in contrast to lower temperature subsolvus members. Similarly, highly fractionated S-type granites show Zr/Hf_{wt} ratio under 30, and contents of P, Y, REE U, and Th are commonly ≥ 0.5 wt%.

Tourmaline supergroup minerals indicate increased boron and other volatile elements in the primary melt. Schorl to foitite occur in Permian, post-orogenic specialized S-type Gemeric granites, locally are present also in some Veporic Permian S-type granites. Highly fractionated members of the specialised S-type granites contain *Nb-Ta oxide* minerals (mainly columbite-group minerals), Nb-Ta rutile, cassiterite and ferberite. Such mineralization typically occurs in greisenised granites. However, scarce Nb-Ta rutile, Ti-rich ixiolite, Fe-rich columbite-tantalite, and ferrotapiolite occur also in fractionated S-type leucogranites in the Tatric Unit. Moreover, some granitic pegmatites derived from S- and rarely I-type granitic magmas contain beryl and accessory minerals of columbite, rarely tapiolite and wodginite groups (Tatric Unit). This Nb-Ta-Sn-(Ti) suite is typical of granites-pegmatites of S- and I-type, in contrast to Y-REE-Ti-Nb-(Ta) suite [fergusonite-(beta)/samarskite-(Y), aeschynite/polycrase-(Y), Nb-rich rutile?] in the hypersolvus A-type granites (Turčok, Gemeric Unit). A special group of rare phosphates was found in Li-F-P topaz- and Li-mica-bearing granite from the Hnilec area (Gemeric Unit) comprising lacroixite, arrojadite, viitaniemiite, gorceixite and goyazite.

Reference

BROSKA, I. PETRÍK, I. & UHER, P. (2011): Accessory minerals in the granitic rocks of the Western Carpathians. Veda Pub. (Bratislava), 250 pp, in press. (In Slovak with English summary)