Geophysical Research Abstracts, Vol. 7, 09440, 2005
SRef-ID: 1607-7962/gra/EGU05-A-09440

Accessory zircon in orogenic to post-orogenic granites and pegmatites: compositional variations as indicator of magmatic evolution. An example from Western Carpathians, Slovakia.

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A detailed electron-microprobe study of accessory zircon from Hercynian orogenic to pre-Alpine post-orogenic, Carboniferous to Lower Triassic granite-(pegmatite) suites of the Western Carpathians (Slovakia) revealed some characteristic features and differences between principal granite-pegmatite petrogenetic groups: S-, I- , A-, specialized S-type granites and pegmatites of the S- and I-type granites.

Zircon of collisional orogenic S-type granites (360-340 Ma) shows progressive increasing of Hf content from center to rim of the crystals, from 1.46 to 1.82 wt.% HfO_2 in average ($Zr/Hf_{wt.}$ = 41.2 and 32.9, respectively), an evidence of magmatic fractionation of the granites. Orogenic I-type granites (360 – 300 Ma) reveal a slightly lower Hf abundances (centers 1.43, rims 1.59 wt. % HfO_2 in average, $Zr/Hf_{wt.}$ = 41.7 and 37.1, respectively), which indicates a lower degree of I-type magma fractionation in comparison to the S-type group.

Zircon from Permian to Triassic, post-orogenic A-type granites (280-235 Ma) reveal different compositions: Hf contents are generally lower, especially for hypersolvus granites (centers 0.96, rims 1.04 wt.% HfO_2in average, $Zr/Hf_{wt.}$ = 61.3 and 56.8, respectively). However, metamict late- to post-magmatic zircon II of A-type group contains around 2 wt.% HfO_2 and elevated Y, REE, U, Th, Al, Fe and Ca contents. The zircon compositions from A-type group reflect a specific magmatic evolution of hot and dry F-rich alkaline magma in comparison to mainly H_2O-bearing calc-alkaline

magma of the S- and I-type groups.

Post-orogenic, Permian specialized (tin-bearing) S-type granites (270-245 Ma) also show two zircon compositions. An early magmatic zircon of slightly fractionated two-mica granites contains around 1.5 wt.% HfO_2 ($Zr/Hf_{wt.}$ = 40.4) in average, without apparent increasing in Hf from center to the rim of crystals. On the contrary, probably late-magmatic zircon from highly-fractionated leucogranites with rare-element Li-Sn-W-Nb-Ta mineralization shows up to 9 wt.% HfO_2 (3.6 wt.% HfO_2in average, $Zr/Hf_{wt.}$ = 19.4) as well as up to 2.8 wt.% P_2O_5 and elevated U, Y and REE contents.

The pegmatites of the S- and I-type granites as the most-fractionated magmatic members reveal also the highest Hf concentrations in zircon: up to 22.2 and 15.5 wt.% HfO_2 in S-type and I-type granitic pegmatites, respectively. The Hf enrichment in pegmatite zircon generally correlates with a presence of rare-element Be-Nb-Ta mineralization (beryl, columbite-tantalite, etc.). Similarly to late-magmatic A- and specialized S-type granites, metamict zircon of the pegmatites shows also higher P, Y, REE, U, Th and Ca contents with apparent xenotime substitution $(Y,REE)P(Zr,Hf)_{-1}Si_{-1}$.