CHEMISTRY OF XENOTIME-(Y) FROM BERYL-COLUMBITE PEGMATITES OF THE PÍSEK REGION (CZECH REPUBLIC)

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Xenotime-(Y) from the albite unit with abundant tourmaline of the beryl-columbite Písek granitic pegmatites have been studied with focus on monitoring of the mineral assemblages, successional position, chemical variability of xenotime, the input of U, Th and REE elements in the structure of the xenotime and to determine their substitution mechanisms.

Primary magmatic xenotime-(Y) forms large euhedral grains (up 2 mm) usually in association with zircon, monazite-(Ce) and U-rich Y,REE,Ti,Nb-oxides. Sometimes it forms hypoparallel intergrows with zircon. Primary xenotime in association with metamict zircon shows magmatic zonal structure with strongly metamict domains. Later xenotime commonly forms along cracks in monazite, or occurs as small inclusions in monazite, moreover, tiny cheralite inclusions are common in later xenotime as well as in surrounding monazite. Furthermore, small later xenotime inclusions occur in highly altered domains of U-rich Y,REE,Ti,Nb-oxides. Rarely, later xenotime together with K-feldspar and Fe-oxides fill cracks in the primary magmatic xenotime. Formation of later xenotime is the result of dissolution-reprecipitation processes during interaction between early magmatic monazite/Y,REE,Ti,Nb-oxides and pegmatite derived fluids.

Primary unaltered xenotime has low to medium concentration of REE (0.17-0.31 apfu) with the highest contents of Dy (0.04-0.08 apfu), Yb (0.02-0.05 apfu), Er (0.02-0.04 apfu), Gd (0.02-0.04 apfu) and Sm (0.01-0.02 apfu). It is characterized by variable U contents (0.5-6.4 wt.% UO_2) and low to medium amount of Th (0.2-4.1 wt.% ThO_2) with high U/Th ratio (commonly 1.3-5.7). Minor Zr (up 2.0 wt.% ZrO_2) and Si (0.1-2.8 wt.% SiO_2) are common in xenotime. The metamict domains in magmatic xenotime lost variable amounts of P, Y, HREE (mainly Yb, Er and Lu), and they are significantly enriched in Ca (up 6.2 wt.% CaO), Th (up 9.4 wt.% ThO_2) and F (up 3.2 wt.% F). Moreover, Zr (up 4.9 wt.% ZrO_2), Fe (up 2.5 wt.% FeO), Sc (up 0.3 wt.% Sc_2O_3) and Ce enrichment was observed in some metamict domains. The U/Th ratio (0.2-1.3) decreases significantly in metamict domains due to the Th enrichment. Later xenotime has lower U and Th contents (0.2-4.5 wt.% UO_2; 0.1-2.4 wt.% ThO_2) compared with primary magmatic xenotime. Moreover, later xenotime along cracks in monazite shows lower contents of the heaviest REE (Er, Yb, Lu). The significant negative Eu anomalies (Eu b.d.l. of EMP) are typical for all types of xenotime. Uranium and thorium enter non-metamict xenotime via (U,Th)$SiREE_{-1}P_{-1}$ substitution vector, mainly coffinite component ($USiO_4$) is important. The Ca contents in non-metamict xenotime are very low and exchange vector $CaThREE_{-2}$ is negligible.

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