UNUSUAL CHEMISTRY OF ZIRCON FROM PERALUMINOUS GRANITES

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We studied zircon from the F, P-rich peraluminous granite system at Podlesí in the western Erzgebirge/Krusné Hory, Czech Republic. Studied rocks comprise albite–topaz–biotite granite (0.5–1.0 wt% F, 0.2–0.4 wt% P_2O_5), highly fractionated albite–topaz–protolithionite granite (0.5–1.2 wt% F, ~0.5 wt% P_2O_5) and late flat dykes of extremely fractionated albite–topaz–zinnwaldite granite (1.0–3.0 wt% F, ~1 wt% P_2O_5). About 350 quantitative electron-microprobe analyses of zircon in 25 representative samples were conducted using the CAMECA SX100 (Masaryk University Brno) and CAMECA SX50 (GeoForschungsZentrum Potsdam) electron microprobes. Some zircons from the Podlesí are extraordinarily depleted (Si, down to 0.30 *apfu*; Zr, down to 0.57 *apfu*) or enriched in several elements, which form trace components in ordinary zircon. The P content increases from 1–3 wt% P_2O_5 in the biotite granite up to about 20 wt% (0.60 *apfu* P) in the late zircon from the zinnwaldite granite. In zoned crystals, the P-content in the cores are higher than those in the rims. Enrichment of U in individual grains is extremely irregular, up to 14.75 wt% UO_2 in zircon from the protolithionite granite. The concentrations of Nb and Bi in zircon are heterogeneous. Nb range from below the microprobe detection limit up to 6.7 wt% Nb_2O_3 (0.12 *apfu* Nb). Some crystals from the protolithionite granite contain up to 7.7 wt% Bi_2O_3 (0.079 *apfu* Bi). The concentration of Sc in zircon is less variable and normally range from below the detection limit to 1.5 wt% Sc_2O_3, exceptionally up 3.42 wt% (0.11 *apfu* Sc). Fluorine is present usually in the heavily altered grains, maximally up to 3.5 wt% in zircon from the dyke granite. The LREE abundances are mostly below their detection limits of the microprobe. The contents of Y and the HREE are highly variable, from below their detection limits to maximal 7.93 wt% Y_2O_3 (0.145 *apfu* Y). The highest Hf concentration (9.1 wt% HfO_2; equivalent to 8.5 mole% $HfSiO_4$) was determined in a zircon grain from the upper part of the protolithionite granite. Among the other elements, aluminium reaches up to 5.5 wt% Al_2O_3, iron up to 3.6 wt% FeO and calcium up to 4 wt% CaO. The most important substitution reactions responsible for the enrichment of some of these elements include the molecules of berlinite ($P^{5+} + Al^{3+} \Leftrightarrow 2Si^{4+}$), xenotime ($(REE + Y)^{3+} + P^{5+} \Leftrightarrow Zr^{4+} + Si^{4+}$), brabantite ($Ca^{2+} + (U + Th)^{4+} + 2P^{5+} \Leftrightarrow 2Zr^{4+} + 2Si^{4+}$), ximengite ($Bi^{3+} + P^{5+} \Leftrightarrow Zr^{4+} + Si^{+}$), and pretulite ($Sc^{3+} + P^{5+} \Leftrightarrow Zr^{4+} + Si^{4+}$). The formation of the abnormal zircon compositions can be attributed to a combination of two factors. One population of zircon crystallized late, from a P-, F- and water-rich melt high in Nb, Ta, Bi, and U, which has undergone a prolonged history of fractionation. These zircons then became further compositionally altered due to interaction with P- and F-rich postmagmatic fluids.