Supergénna uranová mineralizácia na ložisku Banská Štiavnica (Slovenská republika)

Supergene uranium mineralization on the Banská Štiavnica deposit (Slovak Republic)

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Abstract

An interesting association of supergene uranium minerals represented by natrozippeite, zinczippeite, andersonite and zellerite was found at the 12th level of Banská Štiavnica base metal deposit. The most abundant supergene phase, natrozippeite forms bright yellow crystalline coatings which consist of tiny tabular crystals up to 5 μm in size on quartz-sulfide gangue with disseminated uraninite. It is associated together with zinczippeite, gypsum and melanterite. Its refined unit-cell parameters are: a = 17.664(3) Å, b = 14.650(1) Å, c = 17.711(2) Å, β = 104.45(1)°, V = 4438(1) Å^3. Electron microprobe analyses of natrozippeite yielded its average chemical composition Na_2O 3.05, K_2O 0.25, CaO 0.03, MgO 0.13, PbO 0.31, CuO 0.15, MnO 0.06, ZnO 0.27, Al_2O_3 0.12, SiO_2 0.36, SO_3 10.12, UO_3 76.90, $H_2O_{calc.}$ 8.05, total 99.80 wt. % corresponding to the empirical formula $(Na_{2.97}K_{0.16}Mg_{0.10}Zn_{0.10}Al_{0.07}Cu_{0.06}Pb_{0.04}Mn_{0.03}Ca_{0.02})_{\Sigma 3.54}[(UO_2)_{8.12}(SO_4)_{3.82}(SiO_4)_{0.18}O_5(OH)_3]\cdot 12H_2O$ on the basis (S+Si) = 4 *apfu*. Zinczippeite was found as orange-yellow fine crystalline irregular aggregates formed by tiny and imperfect thin-tabular crystals up to 10 μm in size together with natrozippeite, gypsum and melanterite on quartz-sulfide gangue with disseminated uranium mineralization. The refined unit-cell parameters of zinczippeite are: a = 8.655(4) Å, b = 14.261(4) Å, c = 17.691(8) Å, β = 104.16(4)°, V = 2117(1) Å^3 and its average chemical composition is Na_2O 0.26, K_2O 0.48, CaO 0.23, FeO 1.12, MgO 0.50, PbO 0.60, CuO 0.27, MnO 0.25, ZnO 4.33, Al_2O_3 0.14, SiO_2 0.42, P_2O_5 0.17, SO_3 9.71, UO_3 73.83, $H_2O_{calc.}$ 8.24, total 100.53 wt. % corresponding to the empirical formula $(Zn_{0.41}Fe_{0.12}Mg_{0.09}K_{0.08}Na_{0.06}Ca_{0.03}Cu_{0.03}Mn_{0.03}Al_{0.02}Pb_{0.02})_{\Sigma 0.89}[(UO_2)_{1.97}(SO_4)_{0.93}(SiO_4)_{0.05}(PO_4)_{0.02}O_2]\cdot 3.5H_2O$ on the basis (S+Si+P) = 1 *apfu*. Andersonite forms rare transparent apple-green irregular crystals up to 1 mm on quartz-sulfide gangue with disseminated uraninite and abundant coarse-grained aggregates of carbonate (calcite). Its refined unit-cell parameters are: a = 17.9184(6) Å, b = 23.752(1) Å, V = 6604.4(4) Å^3. Qualitative chemical analysis showed only presence of Ca, Na, U, C and O which is consistent with ideal chemical composition of this mineral. Zellerite is the rarest phase in the studied mineral association, it occurs as pale-yellow spherical or reniform aggregates up to 0.2 mm on quartz-sulfide gangue with disseminated uraninite and abundant coarse-grained aggregates of calcite. The refined unit-cell parameters of zellerite are: a = 11.268(9) Å, b = 19.11(1) Å, c = 4.900(3) Å, V = 1055.2(9) Å^3 and its qualitative chemical analysis showed presence of Ca, U, C and O which agrees with the ideal chemical composition of this phase. Described association of supergene uranium minerals represents sub-recent alteration products of primary uraninite, coffinite and base metal sulfides in the environment of the abandoned mine adit.

Key words: *supergene uranium minerals, zinczippeite, natrozippeite, zellerite, andersonite, Banská Štiavnica, Slovak Republic.*