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The new K, Pb-bearing uranyl-oxide mineral kroupaite: Crystal-chemical implications for the structures of uranyl-oxide hydroxy-hydrates

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Abstract

Kroupaite (IMA 2017-031), ideally $KPb_{0.5}[(UO_2)_8O_4(OH)_{10}]\cdot 10H_2O$, is a new uranyl-oxide hydroxyl-hydrate mineral found underground in the Svornost mine, Jáchymov, Czechia. Electron-probe micro-analysis (WDS) provided the empirical formula $(K_{1.28}Na_{0.07})_{\Sigma 1.35}(Pb_{0.23}Cu_{0.14}Ca_{0.05}Bi_{0.03}Co_{0.02}Al_{0.01})_{\Sigma 0.48}[(UO_2)_{7.90}(SO_4)_{0.04}O_{4.04}(OH)_{10.00}]\cdot 10H_2O$, on the basis of 40 O atoms apfu. Sheets in the crystal structure of kroupaite adopt the fourmarierite anion topology, and therefore kroupaite belongs to the schoepite-family of minerals with related structures differing in the interlayer composition and arrangement, and charge of the sheets. Uptake of dangerous radionuclides (^{90}Sr or ^{135}Cs) into the structure of kroupaite and other uranyl-oxide hydroxy-hydrate is evaluated based on crystal-chemical considerations and Voronoi-Dirichlet polyhedra measures. These calculations show the importance of these phases for the safe disposal of nuclear waste.

Keywords*:* Kroupaite, new mineral species, uranyl-oxide hydroxy-hydrate, crystal structure, Voronoi-Dirichlet polyhedral, ^{135}Cs; ^{90}Sr; Jáchymov