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Arsenáty mědi z dobývky na žíle Geschieber - sever (patro Daniel), Svornost, jáchymovský rudní revír (Česká republika)

Copper arsenates from the ore stope at the Geschieber vein - north (Daniel level), Svornost, the Jáchymov ore district (Czech Republic)

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Abstract

An interesting mineral association of Cu arsenates was found at abandoned ore stope at the Geschieber vein - north at the Daniel level of the Svornost mine, the Jáchymov ore district, Krušné hory, Czech Republic. Tangdanite forms thin tabular crystals up to 3 mm in size and coatings and fine crystalline aggregates on the area up to some cm^2. It has light green, bluish-green to emerald green color and perfect cleavage. It is monoclinic, space group *C*2/*c*, the unit-cell parameters refined from X-ray powder diffraction data are: *a* 54.335(12), *b* 5.579(2), *c* 10.459(2) Å, *β* 95.42(3)° and V 3156(2) Å^3; its chemical analyses correspond to the empirical formula $Ca_{1.99}(Cu_{8.72}Zn_{0.09}Ni_{0.04}Al_{0.04})_{\Sigma 8.89}[(AsO_4)_{3.83}(PO_4)_{0.14}(SiO_4)_{0.03}]_{\Sigma 4.00}(SO_4)_{0.41}(OH)_{8.97}\cdot 9H_2O$ on the basis As+P+Si+V = 4 *apfu*. The results of Raman and infrared spectroscopy confirmed an absence of carbonate group in studied tangdanite. K-rich lavendulan was found as a relatively abundant sky blue crusts and coatings on the area up to some cm^2 and hemispherical aggregates with a radial structure or rarely as a group of thin tabular crystals up to 0.2 mm in size. It is monoclinic, space group $P2_1/n$, the unit-cell parameters refined from X-ray powder diffraction data are: *a* 10.081(12), *b* 19.469(12), *c* 10.033(9) Å, *β* 90.32° and *V* 1969(2) Å^3; its chemical analyses correspond to the empirical formula $(Na_{0.63}K_{0.16})_{\Sigma 0.79}Ca_{1.12}(Cu_{4.82}Al_{0.01})_{\Sigma 4.83}[(AsO_4)_{3.86}(PO_4)_{0.07}(SO_4)_{0.06}(SiO_4)_{0.01}]_{\Sigma 4.00}Cl_{0.96}\cdot 5H_2O$ on the basis As+P+V+Si+S = 4 *apfu*. Olivenite occurs as olive green spherical aggregates with radial structure up to 8 mm in size and rarely as groups of acicular crystals in association with strashimirite and köttigite. It is orthorhombic, space group *Pnnm*, the unit-cell parameters refined from X-ray powder diffraction data are: *a* 8.6204(10), *b* 8.2332(9), *c* 5.9337(11) Å and *V* 421.13(7) Å^3; its chemical analyses correspond to the empirical formula $(Cu_{1.94}Ni_{0.01}Al_{0.01})_{\Sigma 1.96}[(AsO_4)_{0.97}(VO_4)_{0.02}(PO_4)_{0.01}]_{\Sigma 1.00}(OH)_{0.93}$ on the basis As+V+P = 1 *apfu*. Strashimirite forms there light green crystalline coatings on the area up to several cm^2 and spherical aggregates with a radial structure in association with olivenite and lavendulan. Strashimirite is probably monoclinic, space group *P*2, the unit-cell parameters refined from X-ray powder diffraction data are: *a* 9.991(9), b 18.466(9), c 8.986(8) Å, *β* 96.5(2)° and *V* 1574(3) Å^3; its chemical analyses correspond to the empirical formula $(Cu_{7.83}Ni_{0.18}Ca_{0.09}Zn_{0.06}Co_{0.02}Al_{0.02})_{\Sigma 8.20}[(AsO_4)_{3.81}(PO_4)_{0.07}(SO_4)_{0.07}(VO_4)_{0.03}(SiO_4)_{0.02}]_{\Sigma 4.00}(OH)_{4.45}\cdot 5H_2O$ on the basis As+P+Si+V+S = 4 *apfu*. Chalcophyllite was found as rare emerald green thin tabular crystals up to 0.5 mm in size and crystalline aggregates. Its chemical composition is possible to express on the basis As+S+P+Si = 7 *apfu* by the empirical formula $Cu_{17.83}Al_{1.97}[(AsO_4)_{4.00}(PO_4)_{0.09}]_{\Sigma 4.09}[(SO_4)_{2.80}(SiO_4)_{0.11}]_{\Sigma 2.91}(OH)_{23.27}\cdot 36H_2O$. Brochantite, devilline, köttigite, erythrite and gypsum were also found in the association with Cu arsenates. The origin of the described mineral association is connected with (sub)recent weathering of primary ore minerals (tennantite, sphalerite, nickelskutterudite) in relatively dry conditions of abandoned mine adits.

Key words: *copper arsenates, tangdanite, lavendulan, powder X-ray diffraction data, unit-cell parameters, chemical composition, Geschieber vein, Jáchymov ore district, Czech Republic*

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