PHOSPHOROUS-RICH PHILIPSBURGITE, A NEW MINERAL SPECIES FROM LAVRION, GREECE

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Recently, philipsburgite with a high content of phosphorous was found at the 1st level of the Christiana 132 area, Kamariza Mines, Lavrion, East Attica, Greece. This mineral phase was studied by electron microprobe analysis and by single crystal X-ray diffraction. The empirical formula is $(Cu_{5,05}Zn_{0,99})_{\Sigma=6.04}(AsO_4)[(AsO_4)_{0,40}(PO_4)_{0,60}]_{\Sigma=1,00}(OH)_6 \cdot H_2O$ and the simplified one is $Cu_5Zn(AsO_4)(PO_4)(OH)_6 \cdot H_2O$. The structure was refined to $R1 = 0.035$ in space group $P2_1/c$ (a = 12.3291(6) Å, b = 9.2189(4) Å, c = 10.7011(5) Å, β = 97.249(2)º, V = 1206.57(2) Å^3, Z = 4).

This mineral belongs to the framework structure type of kipushite $Cu_5Zn(PO_4)_2(OH)_6 \cdot H_2O$ and philipsburgite $Cu_5Zn(AsO_4)_2(OH)_6 \cdot H_2O$. These isotypic structures are characterized by the two distinct tetrahedrally coordinated XO_4 positions, which are either occupied by P or As. CIESIELCZUK et al. (2016) indicated the presence of a solid-solution series between both end-members. In the case of our studied sample the As atoms occupy the $X(2)$ site, while the $X(1)$ site is dominantly occupied by P. In the literature (cf. KRIVOVICHEV et al., 2018) the possibility of such an ordered arrangement, representing a separate mineral species, was already predicted.

Due to the preferred incorporation of P and As in the respective structural sites the mean P-O distance is 1.580 Å, while the mean As-O bond length is 1.684 Å. KRIVOVICHEV et al. (2018) reported at the $X(1)$ position (site occupancy ~$As_{0.63}P_{0.37}$) a mean value of 1.610 Å and for <As-O> of 1.694 Å, respectively.

CIESIELCZUK, J., JANECZEK, J., DULSKI, M., KRZYKAWSKI, T. (2016): Eur. J. Mineral., 28, 555–569.
KRIVOVICHEV, S., ZHITOVA, E., ISMAGILOVA, R., ZOLOTAREV, A. (2018): Phys. Chem. Miner., 45, 917–923.