New Mineral Names*†

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ALEXKHOMYAKOVITE*


Alexkhomyakovite (IMA 2015-013), ideally K4(CaNa)(CO3)2·6H2O, hexagonal, was discovered in a few lumps of the peralkaline pegmatite in the south part of the Koasha open pit (Vostochny mine), Mt. Koasha, Khibiny alkaline complex in Kola peninsula. Alexkhomyakovite is a hydrothermal mineral and occurs associated with villiaumite, titane, potassic feldspar, sodalite, biotite, lamprophyllite, titanite, fluorapatite, wadeite, barwoodite, bodite, ciriottiite, clino-oscarkempffite, ferrovorontsovite, ilmeymite, kannanite, magnesiohornblende, merelanite, oyonite, pararaitsite, petričekite, quijarroite, staroješčíte, tantalowdginite, topsoite, tsyganokite, and vorontsovite.

* For a complete listing of all IMA-validated unnamed minerals and their codes, see http://pubsites.uws.edu.au/ima-cnmnc/.
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ANDREADINITITE*

C. Biagioni, Y. Moelo, P. Orlandi, and W.H. Paar (2018) Lead-antimony sulfosalts from Tuscany (Italy). XXIII. Andreadinitite, CuAgHgPbSb2S8, a new oversubstituted (Cu,Hg)-rich member of the andorite homeotypic series from the Monte Arsiccio mine, Apuan Alps. European Journal of Mineralogy, 30 (5), 1021–1035.

Andreadinitite (IMA 2014-049), ideally CuAgHgPbSb2S8, monoclinic, is a new 4/2L homologue belonging to the andorite sub-series of Sb-rich members within the liillanite homologous series. It was discov-
In a quartz vein embedded in dark gray metadolostone, enriched with microcrystalline pyrite from the Sant’Olga tunnel, Monte Arcisco mine, Stazzema, Apuan Alps, Tuscany, Italy (43°58′16″N, 10°17′05″E). The Monte Arcisco mine exploited a pyrite ± baryte ± iron oxide ore deposit located at the contact between the Paleozoic basement, formed by a metavolcanic-metasedilastic sequence, and the Triassic metadolostone belonging to the Grezzoni Formation. Andreadiniite forms millimeter-sized lead-gray compact masses associated with sphalerite and stibnite. In the same vein, the thallium sulfosalts boscardinite, protochabournéite, and routhierite were identified, associated with Hg-rich tetrahedrite. The crystallization of this sulfosalts assemblage could be related to the circulation of (Pb,TL,Ag,Hg,Sb,As)-rich hydrothermal fluids in the fractures of the metadolostone during the Tertiary Alpine tectono-metamorphic events. The mineral has a metallic luster and is brittle, with a conchoidal to uneven fracture. The indentation hardness VHN_{100} = 223 (218–229) kg/mm², corresponding to ~3.5 of a Mohs scale. Density was not measured, because of the scarcity of homogeneous material; D_{calc} = 5.36 g/cm³. In plane-polarized incident light, andreadiniite is white with a slight yellow bronze tint. No internal reflections, and no pleochroism were observed. Birefringence is extremely weak. In crossed polars, it is weakly anisotropic, in shades of gray to bluish gray. Twinning was not observed but revealed by the X-ray study. The reflectance values in air [R_{air} = R_{air} = 0.067 (R_{calc} = 0.0623) for 3526 λ = 4.45 Å (R_{calc} = 4.46 Å)] are: D_{max} = 0.09 mm, D_{min} = 0.05 mm, 2V_{air} = 2V_{calc} = 53.0°/32.9° (589 cm⁻¹), R_{inc} = 0.09, and R_{reflection} = 0.09. The mineral has a metallic luster and is brittle, with a conchoidal to uneven fracture. The Raman spectra (between 200 and 1200 cm⁻¹) is within experimental uncertainties, very similar to that of medaite. It shows bands (cm⁻¹): 327 bands associated with braunite, quartz, calcite, As-rich medaite, calcian rhodochrosite, talc, and galenohelite. The mineral forms orange-reddish prismatic crystals, up to 200 μm, with a vitreous luster and a white streak. Arsenmedaite is brittle, with a good {100} cleavage and a parting normal to the elongation; fracture is irregular. Hardness, density, and optical properties were not measured due to small amount of available material; D_{calc} = 3.772 g/cm³ and n_{calc} = 1.766.

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Arsenmedaite (IMA 2016-099), ideally Mn₂₆As₂ₘSrOₙ₋₄(OH), monoclinic, is a new mineral discovered in the Molinello mine, Graveglia Valley, Ne, Genova, Liguria, Italy (~N 44°20′43″; E 9°27′32″) in small quartz veins, a few millimeters in thickness, cutting the braunite ore bodies hosted by Jurassic metacherts (“Diaspri di Monte Alpe” Formation). The ore contains polyphase mineral assemblages of manganese, metamorphosed under prehnite–pumpellylite facies (P = 0.25 ± 0.05 GPa, T = 275 ± 25 °C) followed by hydrothermal mobilization along fractures under decreasing thermal conditions, which led to further concentration of dispersed elements such as As, V, and Te in extensional fractures. Arsenmedaite has been found associated with braunite, quartz, calcite, As-rich medaite, calcian rhodochrosite, talc, and galenohelite. Arsenmedaite is interesting for its cubic symmetry, and on the other hand, it is of great interest for its application in the field of ore for the separation of metals.
Si in excess over 5 apfu and (As+V) apfu, showing that the finding of Si-dominated medaite cannot be excluded. The mineral is named owing to this chemical relationship with medaite. The holotype fragments are deposited in the of the Museo di Storia Naturale, Università di Pisa, Italy, and in the collection of the Dipartimento di Scienze della Terra, dell’Ambiente e della Vita (DISTA V), Università degli Studi di Genova, Genova, Italy. F.C.

BARWOODITE*


Barwoodite (IMA 2017-046), Mn$_2$(Nb$^+$,$^+$)$_4$(SiO$_4$)$_3$(OH)$_2$, trigonal, is a new member of the wehrlite group. It was discovered by Henry L. Barwood and Robert W. Stevens around 2005 at the Big Rock quarry (also known as the 3M quarry), Granite Mountain, Little Rock, Pulaski County, Arkansas (34°41’27″N, 92°17’17″W). Barwoodite is interpreted as crystallizing from pegmatic fluids. The mineral is found in mafic lavas in association with biotite, amphibole, and plagioclase.

The crystal structure was solved by direct methods and refined to $R_1 = 0.0246$ for 746 observed reflections. The unit-cell parameters are $a = 8.2031(15)$ Å, $b = 4.8088(9)$ Å, and $c = 280.24$ Å. The structure is based on the hexagonal close-packing of oxygen atoms with the layer sequence ABABABAB along [001], with a AB layer pair per unit cell. The close-packed arrangement contains four different voids that can be occupied by cations in octahedral coordination (M$^{1+}$a, M$^{1+}$b, M$^{2+}$a, and M$^{2+}$b) and two different voids that can be occupied by Si in tetrahedral coordination (Si$^+$ and Si$^-$). Whereas M$^{1+}$a and M$^{1+}$b sites alternate along [001], yielding a chain of face-sharing octahedra, the M$^{2+}$a and M$^{2+}$b octahedra are each grouped in edge-sharing trimers; a single SiO$_4$ tetrahedron above the center of each trimer shares edges with each of the octahedra in the trimer, yielding a heteropolyhedral [M$_2$O$_5$(OH)$_2$SiO$_4$] unit. These units link to one another by sharing octahedra–octahedra and octahedra–tetrahedra corners and they link to M$^+1$ octahedra in the chain by sharing octahedral edges, thereby forming a 3D framework. Barwoodite is isostructural with wehrlite [Mn$_2$(W$_{10}$Mg$_2$Si$_{14}$O$_{47}$)(OH)$_2$], franciscanite [M$^+1$$_2$(V$^+$)$_6$(SiO$_4$)$_3$(OH)$_2$], and oërebroite [Mn$_2$(SiFe)$_2$(SiO$_4$)$_2$].

The mineral name honors Dr. Henry (“Bumpi”) L. Barwood (1947–2016), an American mineralogist (M.S., Auburn University) and surface chemist (Ph.D., Virginia Polytechnic Institute and State University, 1980). The four cotype specimens deposited in the collections of the Natural History Museum of Los Angeles County, California, U.S.A. F.C.

BODIEITE*


Bodieite (IMA 2017-117), ideally Bi$_2$(TeO$_4$)$_2$(OH)$_2$, monoclinic, was first discovered in a sample collected from ore dump in the about 0.2 km west of the North Star mine (but can originate from other nearby mines: Carisa, Boss Tweed, or Red Rose), Tintic district, Juab Co., Utah, U.S.A. It was later also discovered in the dump of the Pittsburg-Liberty mine located in ~19 km NNW of the town of Bodie in the Bodie Hills volcanic field, Masonic district, Mono Co., California, U.S.A. The mineral is named for its type locality. The mines of the Tintic district exploited polymetalllic (Au-Ag-Cu-Pb) veins deposits in contact-metamorphosed dolomite. At that area the mineral occurs in vugs in quartz-baryte matrix in association with mixite, pyrite, and bismuthinite. In the Pittsburg-Liberty former gold mine (exploited a volcanogenic fault-breccia deposit emplaced in granodiorite), bodieite also occurs in vugs in quartz with embedded crystals of gold, bismuthinite, fayalite, magnetite, and ilmenite. Bodieite is an oxidizing-zone mineral. It shows a variety of habits. In specimen from Tintic it forms olive green blades 0.3 mm in length. In the specimens from the Pittsburg-Liberty mine, bodieite forms acicular crystals, occasionally steep pyramidal, or stepped tabular.

The mineral name honors Dr. Henry (“Bumpi”) L. Barwood (1947–2016), an American mineralogist (M.S., Auburn University) and surface chemist (Ph.D., Virginia Polytechnic Institute and State University, 1980). The four cotype specimens deposited in the collections of the Natural History Museum of Los Angeles County, California, U.S.A. F.C.

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based on Bi$^{3+}$O, and Te$^{4+}$O$_2$ pyramids that share O vertices and form an undulating sheet parallel to [001]. These sheets are connected through interlayered [SO$_4$] groups that form long Bi–O and Te–O bonds. Bodieite is structurally distinct from known minerals, but it is isostructural with synthetic Bi$^{3+}$[TeO$_4$(SeO$_3$)] and Bi$^{5+}$[SeO$_4$](SeO$_3$). Five cotype specimens are deposited in the Natural History Museum of Los Angeles County, Los Angeles, California, U.S.A. Yu.U.

**NEW MINERAL NAMES**

**Clino-oscarkempffite**


Clino-oscarkempffite (IMA 2012-086), simplified chemical formula Ag$_x$Pb$_y$Sb$_z$Bi$_y$S$_z$ (Z = 12) or Ag$_x$Pb$_y$Sb$_z$Bi$_y$S$_z$ (Z = 1), is a new monoclinic N = 4 member of the illininite homologous series discovered in the old specimens originating from the 264 level of the Colorada vein, Animas mine, Chocaya Province, Department of Potosí, Sur Chichas, Bolivia, collected by the expeditions of W. Vaux in 1929–1930. The deposit is a typical for the hydrothermal Ag–Sn formation of Bolivia. In the upper parts of the Colorada vein, cassiterite is associated with freibergite and stannite–kësterite family members. Ore textures indicated open space filling by crystallization of ore minerals and telescoping of mineral assemblages. Clino-oscarkempffite is associated with aramayoite, oskempffite, arsenopyrite, ferrokösterite, freibergite, miargyrite, pyrite, and quartz. It occurs in close intergrowth with oskempffite forming discrete anhedral grains with different Sb/Bi ratios and aggregate portions (at least up to 1 mm) with continuous changes in this ratio. Physical and optical properties are practically indiscernable from those of oskempffite (Topa et al. 2016). Clino-oscarkempffite is grayish black, opaque, with metallic luster and dark gray streak. It is brittle, with irregular fracture and no observable cleavage. Indentation hardness VHN$_{200}$ = 200 (189–208) kg/mm$^2$ corresponding to 3–3½ of Mohs scale. Density was not measured; $D_{\text{calc}}$ = 6.04 g/cm$^3$. In reflected light, the mineral is grayish white, with distinct pleochroism between white and gray tones. Anisotropy is distinct with rotation tints in shades of gray. The reflectance values in air [R$_{\text{perc}}$, range] is: Cu 2.33 (2.22–2.41), Ag 0.53 (0.48–0.60), Hg 0.98 (0.92–1.06), Ti 0.78 (0.74–0.81), Pb 44.06 (43.89–44.11), As 4.66 (4.58–4.75), Sb 23.90 (23.77–24.05), Bi 1.75 (1.65–1.83), S 20.37 (20.22–20.46), total 99.38. No other elements with major contents are present.

Other than those defined earlier, the holotype specimens were collected at the Espérance superiore tunnel in the Tavagnasco Pb-Bi-Zn-As-Cu hydrothermal ore district, ~50 km N of Turin, Piedmont, Italy (45.5416 N; 7.8134 E). It was found in a complex sulfide assemblage with chalcopyrite, arsenopyrite, galena, minor amounts of bismuthinite, sulfofarsenite (cosalite, izoklakeite-giessenite), bismuth, and gold. Secondary alteration minerals include anglesite, azurite, langite, and tavagnascoite. In the holotype specimen, ciriottiite is associated with arsenopyrite and a kollinite-like mineral, within a vug of a quartz vein. Ciriottiite forms black tubular crystals, up to 150µm and few micrometers thick with a black streak and metallic lustre. It is brittle. The indentation hardness VHN$_{200}$ = 203 (190–219) kg/mm$^2$, corresponding to ~3–3½ of Mohs scale. No other physical properties are given; $D_{\text{calc}}$ = 5.948 g/cm$^3$. In reflected light, ciriottiite is light gray, distinctly anisotropic with brownish to greenish rotation tints. Internal reflections were not observed and there is no evidence of zonation. The reflectance values in air [R$_{\text{perc}}$, range] is: Cu 2.33 (2.22–2.41), Ag 0.53 (0.48–0.60), Hg 0.98 (0.92–1.06), Ti 0.78 (0.74–0.81), Pb 44.06 (43.89–44.11), As 4.66 (4.58–4.75), Sb 23.90 (23.77–24.05), Bi 1.75 (1.65–1.83), S 20.37 (20.22–20.46), total 99.38. No other elements with Z > 9 were detected. The empirical formula based on 56 S apfu is Cu$_{2.37}$Ag$_{0.60}$Pb$_{1.74}$Tl$_{1.14}$Sb$_{17.3}$As$_{4.0}$Bi$_{0.4}$S$_{54.6}$. The powder X-ray data was not obtained. The strongest lines of the calculated powder X-ray diffraction pattern are [d$_{\text{calc}}$, Å (I$_{\text{calc}}$, %; hkl)]: 3.641 (100; 075), 3.595 (35; 234), 3.238 (82; 01.3), 3.208 (57; 078), 2.936 (54; 088); 2.928 (37; 229), 2.800 (36; 267), 2.043 (78; 402). Single-crystal X-ray data collected from the crystal 0.04 × 0.045 × 0.06 mm shows ciriottiite to be monoclinic, space group P2$_1$/a, a = 8.178(2), b = 28.223(6), c = 42.452(5) Å, $\beta$ = 93.55(2)°, $V$ = 9779.5 Å$^3$. $Z$ = 4. The crystal structure has been refined to $R_{\text{ref}}$ = 0.118 for 21 304 observed $F_{\sigma} > 4e(F_{\sigma})$ reflections. It is topologically identical to that of ciriottiite and oskempffite analogue sterrylite. Cu(Ag,Cu)$_3$Pb$_4$Sb$_6$(As$_3$S$_8$)$_2$. The structure is composed by the fishbone arrangement of complex columns along b. These complex columns delimited by the surfaces of weakest bonding, cutting the longest (Sb/As)–S bonds along distinct zone-electron-pair micelles. A single kind of complex column corresponds to one unit formula. It has a pseudotrigonal prismatic core and two “arms” (ribbon projections) of unequal length. Each complex column contains 16 P6 sites (with minor Bi and Ti), 10 pure Sb sites, 10 mixed (Sb/As) sites (five having As > Sb), and five mixed (Pb/Sc) sites. As in sterrylite, one of the mixed (Pb/Sc) position located on the short arm is connected to a partially occupied Cu site. In the short arm there are two pure As sites, forming localized As–As bonds characterizing both ciriottiite and sterrylite. The other Cu-hosting sites are located in the long arm. At its base, a mixed and split (Cu/Bi) site alternates with a mixed (Cu,Ag,Hg) site the former corresponds to a split (Cu/Ag) site in sterrylite. At the
is monoclinic, space group $P2_1/c$, $a = 39.811(25)$, $b = 19.280(12)$, $c = 8.278(5)$ Å, $\beta = 96.195(9)^\circ$, $V = 6317$ Å$^3$, $Z = 1$. The crystal structure was solved by direct methods and refined to $R[F_o > 2\sigma(F_o)] = 0.0704$. It contains 30 independent cation sites and 36 distinct sulfur sites and consists as a general $N = 4$ lillianite homologue of $[311]_{hex}$ slabs four octahedra thick along $(100)_{hex}$ connected via unit-cell twinning on the $(111)_{hex}$ planes. It is a threefold superstructure of the lillianite aristotype, with a doubled 4 Å axis and, uniquely, a tripled $\sim 13.3$ Å $a$ parameter. The structure is of full mixed cation sites. The central octahedra of the PbS-like slabs are mixed (Bi,Sb), (Sb,Bi), and Sb sites in alternation along the 8.3 Å direction, whereas in the marginal octahedral (Sb,Bi) positions alternate with distorted tetrahedra of Ag. The bicipated trigonal prisms on meeting planes of two octahedral slabs are occupied by mixed (Pb,Bi) sites. Cation occupation schemes result in blocks with monoclinic overall symmetry which alternate along [100] with blocks with orthorhombic overall symmetry. The order-disorder implications of this division are discussed. The substantial difference between formula obtained from structure refinement, $\text{Ag}_2\text{Bi}_4\text{Sb}_6\text{S}_3\text{O}_{9.5}$, and chemical data might be related to variations in Sb/Bi ratio of deeper portions of the X-rayed sample and the analyzed surface as well as to the partial, variable overlap of cation positions. The name is given because of structural and chemical similarity to orthorhombic oscarkempfite. The holotype specimen is deposited in the Natural History Museum Vienna, Austria. D.B.

References cited

ILIRNEYITE*  
I.V. Pekov, O.I. Siidra, Yu.S. Polekhovsky, and A.V. Apelitalei (2018) Iilirneyite, $\text{Mg}_6\text{[ZnMn}_3\text{+]TeO}_4\text{]}_4\cdot 4.5\text{H}_2\text{O}$, a new mineral from Chukotka, Russia. Canadian Mineralogist, 56 (6), 913-921.

Iilirneyite (IMA 2015-046), ideally $\text{Mg}_6\text{[ZnMn}_3\text{+]TeO}_4\text{]}_4\cdot 4.5\text{H}_2\text{O}$, was discovered at the gold-silver Sentyabr’skoe deposit, Iilirney ore district, Western Chukotka, Russia. The new mineral was named for its locality, near the village of Ilirney, the Ilirney Lakes and Ilirneyveem Range. Iilirneyite was found in the oxidation zone of sulfide- and telluride-bearing veins in association with gypsum, malachite, azurite, cerussite, anglesite, brochantite, linarite, posnjakite, chlorargyrite, acanthite, gold, goethite, coronadite, paratellurite, raisaite, and xocomecatlite. Ilirneyite was considered to be formed by the activities of metamorphic fluid accompanied by charge balance for the formula based on Te$_4$O$_7$, in accordance with crystal structure data, Fe$_3$O$_4$·0.06 (0–0.11), TeO$_2$ 65.06 (63.88–65.97), H$_2$O 11.01 (by stoichiometry for 4.5 H$_2$O pfu), total 100.72. The empirical formula is $\text{Mg}_{6}\text{[ZnMn}_3\text{+]Cu}\text{[ZnMn}_3\text{+]}_2\text{Fe}_2\text{Te}_4\text{]}_4\cdot 4.5\text{H}_2\text{O}$ based on Te$_4$O$_7$, and 4.5 H$_2$O pfu. The strongest lines in the powder X-ray diffraction pattern are $d(\AA)$/hkl: 8.18 (100); 4.088 (61; 200), 3.847 (14; 002), 3.087 (15; 2120), 2.977 (16; 112), 2.864 (24; 211), 2.796 (52, 202). The crystal structure was attempted to be solved by direct methods in $P2_1$ and $P3$ space groups. Both obtained models were transformed into $P6_3/m$ space group and the structure was refined to $R = 4.5%$. Iilirneyite is hexagonal, $P6_3/m, a = 9.423(1), c = 7.669(1)\AA, V = 5897.1\AA^3, Z = 2$. Iilirneyite is a member of the zemannite structural family. Its crystal structure is based on $\text{Me}_4\text{(TeO}_3\text{)}_4^{3-}$ framework built of $\text{Me}_2\text{O}$ dimers sharing common corners with $\text{Te}_4\text{O}_7$ pyramids with the Te$^4+$ cation in the apex pointing into the channel. The dominant cations occupying the $\text{Me}$ sites are Zn and Mn$^{2+}$ with minor Mn$^{3+}$, Cu and Fe$^{3+}$. The channels in the $\text{Me}_4\text{(TeO}_3\text{)}_4^{3-}$ framework are filled by chains formed by Mg cations and H$_2$O molecules together with lone electron pairs associated with Te$^{4+}$. The type specimen is deposited in the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. Yu.U.

KANNANITE*  
D. Nishio-Hamane, M. Nagashima, N. Ogawa, and T. Minakawa (2018) Kannanite (IMA 2015-100), Ca$_2$(Al,Mn$^{3+}$,Fe$^{3+})_3$·Mg$_2$·VO$_4$·(Si$_2$O$_7$)·(OH)$_2$, orthorhombic, is a new Ca-dominated member of the ardenneite series. It was discovered in Kannan Mountain, Ozu, Ehime Prefecture, Japan (33°31′02″N 132°37′58″E). The metamorphic rocks of the Kannan unit consist of metamorphosed basaltic tuff and lava, metagabbro, metadolerite, and metachert, exposed to metamorphism in the pumpellyite–actinolite facies. Kannanite was found in an approximately 50 cm thick layer of iron–manganese ore in the metachert. The ore consists mainly of quartz and hematite, in association with braunite. Kannanite occurs in fine quartz veins cross the hematite-rich part, associated to ardenneite-(V). Both kannanite and ardenneite-(V) are considered to be formed by the activities of metamorphic fluid accompanied with the Sanbagawa metamorphism. The mineral forms brownish orange to orange several micrometers and (rarely up to 15 μm) vivid crystals, fragmented into anhedral grains with tabular and columnar shapes, with frequent voids. No fluorescence in UV range was observed. Cleavage is not observed but expected to be perfect on $\{010\}$ by analogy with ardenneite. Mohs hardness is 6. Density and optical properties were not measured, owing to the small grain size; $D_{\text{meas}} = 3.34$ g/cm$^3$, $\rho_{\text{calc}} = 1.788$. Kannanite is weakly pleochroic from orange to brownish orange. Of arsendematite. In Raman spectrum peaks are evident at 300–1000 and 3000–3700 cm$^{-1}$ and by analogy with ardenneite-(As) have been assigned as 371 cm$^{-1}$ (ν$_s$, symmetric bending vibrations), 421 cm$^{-1}$ (ν$_d$, out-of-plane bending modes for VO$_4$ units), 779–881 cm$^{-1}$ (VO$_4$ antisymmetric and symmetric stretching vibrations), and 3400–3600 cm$^{-1}$ (O–H stretching vibrations). The average of 12 WDS electron probe analyses on grains from a single vein [w% (range)] is: VO$_4$: 6.04 (5.49–6.53), As$_2$O$_3$: 1.52 (1.38–1.78), SiO$_2$: 29.73 (28.73–29.84), Al$_2$O$_3$: 14.40 (13.85–15.13), Fe$_2$O$_3$: 5.18 (4.83–5.44), MnO$_2$: 12.65 (11.86–13.99) (MnO 3.89 and MnO$_2$: 9.74, according to electroneutrality), CaO 19.02 (17.34–19.68), MgO 2.70 (2.57–2.82), CuO 0.34 (0.23–0.46), NiO 0.40 (0.30–0.51), H$_2$O 5.22 (according to electroneutrality, 28 anions and 16 cations), total...
The order of amount of the trivalent cations in kannanite is Al > Mn in terms of cations in crystal X-ray data are provided. Ardennite-series minerals are classified the space group cell parameters refined from the powder data are (37; 204), 3.001 (100; 115,020), 2.809 (35; 121), 2.715 (66; 122), 2.658 (41; 116,120). The strongest X-ray powder diffraction lines are [2A] [3(hkl)] 3.234 (37; 204), 3.001 (100; 115,020), 2.809 (35; 121), 2.715 (66; 122), 2.658 (41; 116,120). The e periodicity and the space group Pnam were confirmed by electron diffraction. No single-crystal X-ray data are provided. Ardenite-series minerals are classified in terms of cations in A (3+), T (4+), A (2+) and M site (M2+ and M3+) cations. Kannanite is V-dominant in 74 site, Ca dominant at the A sites, and the M1 and M2 sites are occupied only by trivalent cations, whereas the M3 site is shared by both trivalent and divalent cations (half by Mg and small amount of Mn3+ and other half by the trivalent cations). The order of amount of the trivalent cations in kannanite is Al > Mn > Fe > Mg and is dominant compared to Mn3+ > Fe3+. The mineral is named for its type locality. The holotype specimen has been deposited in the National Museum of Nature and Science, Tokyo, Japan. F.C.

**Magnesio-hornblende**


Magnesio-hornblende (IMA 2017-059), ideally [37]Ca2Mg3(Al2Si3(OH)6), monoclinic, is a new mineral of the amphibole supergroup (Hawthorne et al. 2012). It was found in 1970 by M.E. Ciriotti in the sand dunes of the Lüderitz, Karas Region, Namibia (~26°38′52″S, 15°09′28″E). Dune sands in the coastal Namibia are invariably lithofeldspatho–quartzose volcaniclastic and have a homogeneous composition from Lüderitz to Walvis Bay. Plagioclase exceeds K-feldspar. Mafic volcanic rock fragments predominate over granitoid, sedimentary (quartzose layers and can be described as “scrolls” terminated in a conical shape. The mineral is opaque, non-fluorescent in UV light. It has dark gray to black pleochroic gray to white, strongly bireflectant and strongly anisotropic. The mineral is typically tens (up to 100) of micrometers in diameter and up to a millimeter, rarely up to 12 mm long. SEM study shows it consisting of tightly coiled graphite crystals. Merelaniite metallic dark gray cylindrical whiskers are typically 0.40 mm long and 0.05 mm wide. The mineral is named for its type locality. The holotype specimen has been deposited in the National Museum of Nature and Science, Tokyo, Japan. F.C.

Merelaniite (IMA 2016-042), ideally Mo15Pb15V15Si36O108(OH)24F15, is a new mineral species, the first Mo-essential member of the cylindrite homologous series discovered at the tanzanite gem mines in the Merelani hills near the town of Arusha, Lelatema Mountains, Manyara Region, Tanzania (~3°35′50″S, 37°03′E). It is named after the township of Merelani, in honor of the local miners, past and present, living and working in the region. Merelaniite might be identical to the mineral from Kayraty, Kazakhstan (Yanulova and Kosyak 1971) and to “unnamed Pb–Mo sulfide” from the Sätä mine in Sweden (Zakrzewski et al. 1982) later listed as valid unknowns (“UM1971-18-S:MoPbSb” and “UM1982-13-S:MoPb” respectively (Smith and Nickel, 2007). At Merelani it was originally noticed as “molybdenite” wires piercing chabazite crystals from (Simmonf and Wise, 2012, 2014). Organic and vanadium rich sedimentary “black shales” of Merelani region undergone ultrahigh temperature (granulitic facies) metamorphism at ~1000 °C with pressures up to 10–12 kbar. The formation of large sulfide crystals associated with well crystalized “flake” graphite would suggest a high temperature. The partial coiling of the sulfides and later influxing of cracks and voids by lower-grade metamorphic phases such as the zeolites and prehnite indicates these multiple phases of reworking and deformation. Merelaniite growth potentially took place between initial deformation and one or more of the retrograde events. All the specimens with identified Merelaniite have been obtained from the secondarily mineralized “zone” with big wurtzite and alabandine crystals was mined at ~2011–2013. Merelaniite was formed after alabandite and wurtzite, yet prior to quartz, calcite, prehnite, fluorapatite, zoisite (tanzanite), chabazite, and other zeolites, which have all been observed to fully or partially encapsulate fully formed merelaniite whiskers. Other associated minerals include diopside, graphite, tremolite, titanite, clausenthalite, and pyrite. Merelaniite whiskers also occur in crevices attached to the surfaces of large alabandite crystals, intimately associated with masses of loosely aggregated yet well-formed graphite crystals. Merelaniite metallic dark gray cylindrical whiskers are typically tens (up to 100) of micrometers in diameter and up to a millimeter, rare only to 12 mm long. SEM study shows it consisting of tightly coiled layers and can be described as “scrolls” terminated in a conical shape. The mineral is opaque, non-fluorescent in UV light. It has dark gray to black streak. Whiskers are malleable, flexible with a splintery fracture. Cleavage is perfect on {001}. Hardness and density were not determined; D = 4.65 g/cm3 (for an ideal formula). In reflected light, merelaniite is weakly pleochroic gray to white, strongly bireflectant and anisotropic with pale blue and orange-brown rotation tints. The reflectance values in air [R7/R6 (nm)] (interpolated COM wavelengths bolded) are: 37.6/47.6
NEW MINERAL NAMES

PbS$_3$ - 2PbS$_3$ PbS$_3$


Oyonite* L. Bindi, C. Biagioni, and F.N. Keutsch (2018) Oyonite, Ag$_2$Mn$_{2+}$Pb$_4$Sb$_{4+}$As$_{3+}$S$_{5-}$. A New Member of the Lillianite Homologous Series from the Uchucchacua Base-Metal Deposit, Oyon District, Peru. Minerals, 8(3), 192.

Oyonite (IMA 2018-002), ideally Ag$_2$Mn$_{2+}$Pb$_4$Sb$_{4+}$As$_{3+}$S$_{5-}$, monoclinic, is a new mineral species discovered in the specimen obtained at the mineral market, which was collected in 2010 from Nivel 890, Uchucchacua deposit, Oyon district, Catajamba, Lima Department, Peru. The mineral was named for its type locality. Uchucchacua deposit is the type locality for other four Mn-bearing sulfosalts: uchuchachaite, benaisdevite, manganoquatdrilate, and mechenite. Oyonite is the unique variety with spitznagel-tetradrite structure, and other minerals of the system Pb-Ag-Sb-Mn-As-S, in calcite matrix. The new mineral occurs as very rare black metallic subhedral to anhedral crystals, up to 100 µm with a black streak. It is brittle with a micro-indentation hardness VHN$_\text{ind}$ = 137 (132–147) kg/mm$^2$ corresponding to 3–3 ½ of Mohs scale. Density was not measured; $D_{\text{calc}}$ = 5.237 g/cm$^3$ (5.275 for ideal formula). In reflected light, oyonite is weakly to moderately bireflectant and weakly pleochroic from dark gray to dark green. Internal reflections are absent. Reflectance values are provided only for the COM wavelengths [Real $R_{\text{comp}, \%}$ (nm)] are: 33.9/40.2 (471.1), 32.5/38.9 (548.3), 31.6/38.0 (586.6), 29.8/36.5 (652.3). The average of five electron probe WDS analyses [wt% (range)] is Cu 0.76 (0.50–1.05), Ag 8.39 (8.08–8.91), Mn 3.02 (2.89–3.22), Pb 24.70 (24.55–25.81), As 9.54 (9.11–9.82), Sb 28.87 (28.24–29.61), S 24.30 (23.63–24.71), total 99.58 with other elements below detection limits. The empirical formula based on 20 cations pfu is Cu$_2$Ag$_{0.26}$Mn$_{0.74}$Pb$_{3.93}$Sb$_{2.27}$As$_{3.07}$S$_{5.12}$

References cited


**PARARAISET**


Pararaisaite (IMA 2017-110), ideally Cu$_2$Te$_4$O$_2$(OH)$_2$.6H$_2$O, monoclinic, was discovered in the dumps of North Star mine (exploited polymetallic Au-Ag-Cu-Pb vein deposit), Mammoth, Tintic district, Juab Co., Utah, U.S.A. Pararaisaite is an oxidation-zone mineral, as bodite abstracted in this issue. It occurs in veins in a massive quartz with embedded crystals of baryte and goldfieldite, with a secondary malachite. The main minerals of the ore zone include galena, cerussite, and enargite. The new mineral forms blue, striated, prismatic crystals up to 0.4 mm elongated on [010]. The forms are: [100], [001], [102], [102], [114]. Pararaisaite is transparent, has a white streak and vitreous luster. No twinning was observed. It is nonfluorescent under long- and short-wave UV light. The Mohs hardness is 2½. The mineral is brittle with a splintery fracture, has the perfect cleavage on [010]. The mineral is named for the relation to its mineral form, Potosi, Bolivia and in Sierra de Cacheuta, Mendoza, Argentina.

Petříčekite (IMA 2015-111), ideally Cu$_2$Se$_2$, orthorhombic, is a new member of the marcasite group discovered from the Předbořice Deposit, Central Bohemia Region, Czech Republic. Minerals, 6(2), 33.

Petříčekite (IMA 2015-111), ideally Cu$_2$Se$_2$, orthorhombic, is a new member of the marcasite group discovered at the Předbořice uranium deposit, Central Bohemian Region, Czech Republic. It was also found at El Dragón mine, Potosi, Bolivia and in Sierra de Cachuta, Mendoza, Argentina. Mineralized fissures Pararaisaite are complicated low-temperature hydrothermal veins up to 25–100 m long, 25–50 m high, and up to 30 cm (max. 1 m) thick, cutting through the metamorphic rocks close to its contact with granitoids of central Bohemian pluton. The main ore mineral is unaniite. The main gangue minerals are quartz, hematite-bearing calcite, and barite. Mineralization also includes among others a number of rare selenides: aguilarite, athabascaite, berzelianite, bukovite, cháméantie, christianelyte, claustralhite, eskebornite, eucarite, ferroselite, giraudite, jollifeite, krut’aite-trogalite series, klockmannite, merenskyite, naumannite, telargpalite, tiemannite, tyrrellite, umangite, fischemerite, hakti, miloait, permegenticite, and native gold. In El Dragón mine selenides dominating over sulfides in small hydrothermal veins (to 4 cm thick) cutting black shale and silt stone. Petříčekite formed as a late-stage mineral in the Se mineralization. At the Sierra de Cachuta deposit selenium mineralization occurs in calcite veins in porphyry forming a fine-grained mixture of claustralhite, naumannite, klockmannite, umangite, berzelianite, eucarite, tyrrellite, and eskebornite. Petříčekite identified here based on optical and chemical data. This deposit is the type locality for achávalite and molybdobentine. Petříčekite, has been found in two specimens from Předbořice bought at a mineral fair and in old specimen from Sierra de Cachuta obtained same way. The origin of material from El Dragón was not specified. In the specimens from Předbořice petříčekite occurs either as rare fractured inclusions up to 150 µm in large eucarite grains closely associated with athabascaite/ klockmannite and unknown (under investigation) selenides, or as fractured inclusions in tiemannite closely associated with eskebornite. At El Dragón petříčekite forms euhedral to subhedral crystals up to 25 µm (often intergrown with krut’aite of an ideal composition and the phase with composition close to Cu$_2$Se$_2$) and skeletal and/or myrmekitic aggregates up to 200 µm filling cracks, pores and interstices in brecciated krut’aie-penroseite. Homogeneous grains are exceptional and usually partly or completely replaced by krut’aie. Klockmannsite, watkinsonite, and native selenium found in grain-boundary contacts. Other associated minerals include quartz, calcite, barite, covellite, goethite, lepidocrocite, chalcocinite, molybdobentine, olaschite, schmiederite, ahlfiedite, favreite, felsóbányite, and allolpanite. In the sample from Sierra de Cachuta claustralhite partly replaced by krut’aie, petříčekite, molydobentine, and native selenium. Petříčekite is black, opaque with a black streaky and metallic luster. It is brittle, has uneven fracture. No cleavage was observed. Micro-indentation hardness VHN$_{100}$ is 33 (28–40) kg/mm$^2$ corresponding to ~2–2½ of a Mohs scale. Density was not measured due to small grain size; $D_{meas}$ = 6.673 g/cm$^3$. In reflected light, petříčekite from Předbořice is weakly pleochroic from pale blue gray to pale pinkish, and weakly bireflectant. It is anisotropic with light gray-blue to light pink rotation tints. Internal reflections were not observed. Pleochroism (from violet to blue) and anisotropy (with copper-red to light gray rotations) increase significantly for near endmember petříčekite from El Dragón. The reflectance values in air for Předbořice sample (Cu$_{1,02}$Fe$_{0,07}$ (Se$_{0,28}$S$_{0,07}$)) vary in 400–700 nm interval from 41.9 to 42.8% for R$_b$, and from 41.5 to 44.6% for R$_m$. The COM wavelengths [R$_b$/R$_m$ (%) mm] are: 42.35/41.8 (470), 42.0/42.2 (546), 41.9/42.3 (589), 42.0/42.5 (650). The reflectance values for El Dragón sample (Cu$_{1,09}$Fe$_{0,02}$ (Se$_{0,28}$S$_{0,07}$)) differ significantly [R$_b$/R$_m$ (%) mm]; COM wavelengths are banded: 26.9/50.7 (400), 25.7/44.0 (420), 24.9/40.2 (440), 24.2/37.5 (460), 23.7/36.3 (470), 23.7/35.1 (480), 23.1/32.8 (500), 22.3/30.6 (520), 21.5/28.6 (540), 21.4/28.2 (546), 21.1/27.1 (560), 21.8/25.7 (580), 21.9/25.1 (589), 22.5/24.4 (600), 24.6/23.3 (620), 27.9/22.8 (640), 29.8/22.9 (650), 31.7/23.0 (660), 35.8/24.3 (680), 39.4/27.1 (700). The averaged electron probe WDS analyses for 9 points (all samples from Předbořice) are: Ag 0.22 (0.09–0.46) 0.37 (0.1–1.46) 0.04 (0.04–0.45), Cu 15.39 (15.10–15.56) 16.81 (13.81–21.45) 28.42 (28.21–28.58) Hg 0.01 (0.0–0.07) 0.33 (0.3–0.6) Pb 0.03 (0.0–0.07) 0.01 (0.0–0.07) Fe 12.18 (12.02–12.34) 9.47 (5.34–12.64) Pb 0.11 (0.02–0.17) 1.26 (0.96–4) Se 0.0 0.01 (0.0–0.10) S 0.09 (0.08–0.10) 0.08 (0.0–0.19) 0.03 (0.02–0.03), Se 71.61 (71.10–71.90) 71.19 (68.83–71.97), total 99.67 99.78 99.88. The empirical formula based on 3 apfu are: (Cu$_{1,15}$Fe$_{0,02}$Al$_{0,07}$Zn$_{0,06}$Na$_{0,03}$)$_{2+}$/ 0.32 (0–0.10)/ –, Cu$_{0,03}$S$_{0,07}$ (Se$_{0,28}$S$_{0,07}$)$_{1+}$/ 0.05 (0–0.10)/ –, Cu$_{0,03}$Se$_{0,07}$ (Se$_{0,28}$S$_{0,07}$)$_{2+}$/ 0.32 (0–0.10)/ –, Cu$_{0,03}$S$_{0,07}$ (Se$_{0,28}$S$_{0,07}$)$_{3+}$/ 0.32 (0–0.10)/ –. American Mineralogist, vol. 105, 2020
sample from Sierra de Cachetta for which wt% data for is not provided). The Cu- richest additionally structurally studied composition from Předbořice is [Cu$_{0.74}$Fe$_{0.30}$]$_{1.21}$Se$_{2.06}$. The composition most close to endmember from that deposit is [Cu$_{1.00}$Fe$_{0.27}$]$_{1.07}$Ag$_{0.03}$[0.03]Se$_{1.00}$. The composition of the Pd-richest grain is [Cu$_{0.79}$Fe$_{0.22}$Pd$_{0.07}$Ni$_{0.03}$Ag$_{0.03}$]$_{1.20}$Se$_{2.06}$. The strongest powder-diffraction lines [d Å (เทศกาล; hkj)] are: 2.938 (70; 101), 2.639 (100; 111), 2.563 (85; 120), 1.935 (76; 211), 1.834 (30; 002), 1.760 (25; 031), 1.492 (25; 122). The unit-cell parameters refined from the powder X-ray data are: a = 4.9072(3), b = 6.0116(4), c = 3.6671(5) Å, V = 108.18 Å$^3$. The single-crystal X-ray data collected on the crystal 0.035 × 0.045 × 0.05 mm shows petříčekite is orthorhombic, space group Pnnn, a = 4.918(2), b = 6.001(2), c = 3.670(1) Å, V = 108.31 Å$^3$; Z = 2.

The crystal structure refined to R = 0.036 for 159 F $>4σ$ (F2) reflections. It is a marcasite-type structure consisting of edge-sharing chains of CuSe$_4$ octahedra parallel to [001] to join by sharing Se$_8$ dimers. The Se–Se bonds are all parallel to [001]. The mineral name honors Václav Petříček (b. 1948), Czech crystallographer (Institute of Physics of the Czech Academy of Sciences, Prague), for his outstanding contributions to crystallography. The holotype is deposited in the Mineralogical and Geological Museum at Harvard, U.S.A. D.B.

**Quijarroite**

H.-J. Förster, L. Bindi, G. Grundmann, and C.J. Stanley (2016) Quijarroite, Cu$_{2}$Hg$_{3}$Bi$_{12}S_{25}$, a new selenide from the El Dragón Mine, Bolivia, Minerals, 6(4), 123.

Quijarroite (IMA 2016-052), ideally Cu$_{2}$Hg$_{3}$Bi$_{12}S_{25}$, orthohombic, is a new species discovered at the El Dragón mine, Antonio Quijarro Province, Department of Potosí, Bolivia and named for its type locality. The almost vertical ore vein is in the center of a 1.5 m wide shear zone thinly stratified, pyrite-rich black shales and reddish-gray, hematite-bearing siltstones of probably Devonian age. Selenium mineralization consisted of a single vein ~15 m long and mostly 0.5 to 2 cm thick and represents a multi-phase assemblage of primary and secondary minerals enriched with Se-bearing species. It is the type locality of eldredgionite, favreautinite, grandnannite, hamsblockite, alfredopetrovite, and petříčekite. Quijarroite is a primary mineral, deposited from an oxidizing low-T hydrothermal fluid. The new mineral resembles phase “A” (Paar et al. 2012), Cu$_2$Hg$_2$Bi$_{12}S_{25}$ for which no structural data was provided and might be a polymorph of “Bi-rich petrovicite” Cu$_{1.00}$Hg$_{0.60}$Pb$_{0.40}$Bi$_{12}S_{25}$ (Dymkov et al. 1990). Quijarroite mostly forms lath-shaped thin plates up to 150 × 20 μm intimately (subparallel) intergrown with hamsblockite. Occasionally it occurs as sub- to anhedral grains up to 200 × 50 μm either alone in the matrix or intergrown with wakimconite, clausthalite, eldredgionite, knut nannite, eskebornite, klockmannite, umantzige and rarely, in grain-boundary contact, petrovicite, grandnannite, and native gold. The mineral is black, opaque, non-fluorescent, with a metallic luster and black streak. It is brittle, with an irregular fracture and no obvious cleavage and parting. The density and Mohs hardness were not measured due to the small grain size; D$_{calc}$ = 5.771 g/cm$^3$. In reflected light, quijarroite is weakly pleochroic from cream to very slightly more brownish cream, displaying no internal reflections. It is a galena derivative and its structure can be derived from that of bournonite. Polycrystallized by Pb, Bi trigonal pyramids, and Cu tetrahedra share corners and edges to form a three-dimensional network. Cu$_2$Se$_4$ tetrahedra share corners to form chains parallel to [001]. In quijarroite only one of the two Pb positions of bournonite (2b Wyckoff position) is occupied by Pb, whereas the second is vacant and replaced by a general position occupied by Cu and Hg (with site occupation: Cu$_{1.00}$Hg$_{0.60}$), showing almost perfect line coordination. Comparing with bournonite, the structural formula of quijarroite can be written as [Cu$_{1.00}$Bi$_{12}$(Cu$_{0.75}$Hg$_{0.25}$)Pb$_{0.25}$BiSe$_{25}$] (Z = 4), which for Z = 1 equals to Cu$_2$Hg$_2$Pb$_2$Bi$_{12}S_{25}$. The X-rayed crystal fragment is deposited in the Florence Museum, Italy. The polished section, from which the holotype crystal fragment was extracted, is housed in the Natural History Museum, London. The cotype is deposited within the Mineralogische Staatssammlung München, Munich Reich der Kristalle. Germany. D.B.

**References cited**


**Staročeskéite**

R. Pažout and J. Sejkora (2018) Staročeštěskéite, Ag$_{0.96}$Pb$_{0.04}$(Bi$_{13.3}$Sb$_{1.2}$)$_{29}$S$_{60}$ from Kutná Hora, Czech Republic, a new member of the illianinite homologous series. Mineralogical Magazine, 82(4), 993–1005.

Staročeštěskéite (IMA 2016-101), ideally Ag$_{0.96}$Pb$_{0.04}$(Bi$_{13.3}$Sb$_{1.2}$)$_{29}$S$_{60}$, orthohombic is a new member of illianinite homologous series of sulfosalts with N = 4. It has been discovered at the medieval mine dumps of Staročeštěskéite pásma Lode of the Kutná Hora ore district, 60 km east of Prague, Central Bohemia, Czech Republic. Originally compositions corresponding to staročeskéite were detected in 2005. Then it was considered as an intermediate member between gustavite and andorite-group minerals. Later the structure was solved (Pažout and Dušek 2010) but the phase was recognized as only one of the new members of the Ilianinite homologous series. 140th century to 16th century, with hundreds of mines on twelve major lodes each of those represents a hydrothermally altered zone of several hundred meters to about 3 km long and dozens of meters wide, with the depth range between several hundred meters to about 1 km, each consisting of several, usually parallel veins. The new mineral was found in quartz gangue in the rich Ag–Pb–Bi–Sb sulfosalt association and was formed in the late-stage Bi-mineralization phase with other illianinite homologues. gustavite, terrywallaceite, vikingite, treasurite, eskimoite, erzwiesite, Bi-rich fizé, and Bi-rich ramdohrite along with Ag- and Bi-bearing galena and Pb–Bi–Sb sulfosalts (izoklakeite, cosalite, and Bi-rich jamesonite). The origin of this mineralization is related to the penetration of low-temperature fluids (~100–250 °C) into tectonically opened fractures in older ore vein fillings (pyrite,
arsenopyrite and stannite). Staročeskéite forms lath shaped crystals or anhedral grains up to 80 μm × 70 μm, growing together in aggregates up to 200 μm × 150 μm across. It is steel-gray with a metallic luster. No other data on physical properties is provided; $D_{calc} = 6.185$ g/cm$^3$. In reflected light staročeskéite is greyish white; bireflectance and pleochroism are weak with greyish tints. Anisotropy is weak to medium with gray to bluish gray rotation tints. Internal reflections were not observed. The reflection values in air ($R_{calc} / R_{meas}$ (nm)) [COM wavelengths bolded] are: 41.6/39.3 (400), 41.7/37.9 (420), 41.6/39.6 (440), 41.0/39.2 (460), 40.8/39.0 (470), 40.5/38.7 (480), 40.2/38.4 (500), 39.8/38.0 (520), 39.5/37.7 (540), 39.4/37.6 (546), 39.2/37.4 (560), 38.9/37.1 (580), 38.8/37.1 (589), 38.7/37.0 (600), 38.5/36.8 (620), 38.4/36.8 (640), 38.3/36.5 (670), 38.4/36.7 (660), 38.3/36.6 (680), 38.1/36.5 (700). The average of five WDS electron probe analyses [wt% (range)] is: Ag 7.02 (6.61 – 7.51), Cu 0.05 (0.04 – 0.07), Fe 0.05 (0.04 – 0.05), Pb 31.09 (29.67 – 31.82), Cd 0.10 (0.09 – 0.12), Bi 26.62 (25.36 – 27.94), Sb 16.01 (14.74 – 16.69), Se 0.07 (0.06 – 0.08), Nb 0.05 (0.04 – 0.07), Bi 26.62 (25.36 – 27.94), Sb 16.01 (14.74 – 16.69), Se 0.07 (0.06 – 0.08).

**NEW MINERAL NAMES**

**2. Tantalowodginite**

**A. Staročeskéite**

**B. Staročeskéite**

**References cited**

Pažout, R., and Dulek, M. (2010) Crystal structure of natural orthorhombic Ag$_{0.5}$Pb$_{0.5}$Bi$_{2}$Sb$_{0.5}$As$_{2}$, a lillianite homolog with $N = 4$; comparison with gustavite. European Journal of Mineralogy, 22, 741-750.


**Tantalowodginite**

**A. Staročeskéite**

**B. Staročeskéite**

**References cited**


Topsyee (IMA 2016-113), ideally FeF_2(H_2O), tetragonal, was discovered in the fumaroles of the Hekla Volcano, Iceland, in the specimen collected in 1992 after the 1991 eruption. The temperature in the fumarole at the time of sampling was 170 °C. A preliminary description was given by Jakobsson et al. (2008) under the name HI (UM2008-30-F:FeHO). Topsyee forms short, pseudocubic tetragonal prisms up to several tens of micrometers, crystal aggregates up to 100 μm, or fractured veins inside up to 3 mm thick yellow to brown crust on altered scoria, together with hematite, opal, malardite, heklaite, raistinite, and several other not fully characterized minerals. Topsyee is yellow with irregular fracture and no prominent cleavage observed. Density and optical properties were not measured due to tiny size of crystals and intimate admixture with other minerals; D_cal = 2.067 g/cm^3. For an ideal formula D_cal = 2.330 and n(calc) = 1.63. The averaged 11 point electron probe EDS analyses on unpolished surface is [wt%, (range/standard deviation)]: Fe 38.52 (33.50–42.92/3.34), F 38.23 (33.20–43.67/3.48), Cl 1.03 (0.86–1.43/0.25), O 21.20 (19.55–22.60/1.85), total 99.88. The empirical formula based on one atom of Fe plus Fe(H_2O) is FeF_2(H_2O). The strongest lines of the powder X-ray diffraction pattern are [d Å (R/%; hkl)]: 5.55 (100; 110), 3.92 (43; 020), 3.47 (39; 011), 3.17 (22; 111), 2.77 (30; 220), 2.479 (31; 130; 310), 1.877 (16; 012), 1.753 (24; 240; 420). The crystal structure of Topsyee was solved and refined by the Rietveld method to R = 3.98%. Topsyee is tetragonal, P4/n, a = 7.8381(3), c = 3.8674(1) Å, V = 237.60 Å³, Z = 2. The X-ray data matches well with that of synthetic β-FeF_2(H_2O). The structure consists of straight infinite chains of FeF_2(H_2O) octahedra extending along the c axis. The adjacent octahedra share apical F atoms. Four unshared, equatorially positioned atoms are disorder two F and two O atoms from H_2O molecules.

The Fe octahedra share apical F atoms. Four unshared, equatorially positioned atoms are disorder two F and two O atoms from H_2O molecules.

The electron probe WDS analyses [wt% (range)] is Mn 6.29 (6.15–6.40), Hg 5.42 (5.31–5.58), Ti 26.05 (25.25–26.53), Pb 5.84 (5.01–6.34), As 3.39 (3.15–3.72), Sb 30.89 (30.32–31.39), S 21.87 (21.40–22.40), total 99.75. The empirical formula, based on 90 apfu, is Mn_{0.95}Ti_{1.00}Hg_{0.00}Pb_{0.00}Sb_{0.01}S_{48.03}As_{48.03}Pb_{0.00}S_{48.03}.

No X-ray powder diffraction data was obtained due to lack of material. The strongest lines of the calculated powder X-ray diffraction pattern are [d Å (I/%; hkl)]: 3.8668 (38; 207), 3.5877 (100; 112), 3.5549 (44; 602), 3.3916 (68; 208), 3.3533 (70; 714), 3.2044 (88; 405), 2.9885 (45; 313), 2.7860 (99; 514). Single-crystal X-ray data obtained on crystal fragment 0.032 x 0.017 x 0.007 mm shows tseygankoite is monoclinic, space group C2/m, a = 21.362(4), b = 3.8579(10), c = 27.135(4) Å, β = 106.944(14)°, V = 2193.19 Å³, Z = 1. The crystal structure of Topsyee was refined to R = 0.0067 for 957 unique [I > 3σ(I)] reflections. The structure is unique among minerals having partial similarity to that of rouxelite CuHgPb_2Sb_2S_6O_4. It consists of an alternation of two thick layer-like arrays of PbS- and SnS- architectures. The former contains a Hg site, Ti site, octahedrally coordinated Mn site, and pure Sb site. The latter contains four distinct Sb sites, all of which statistically mix with either heavier Pb or Ti cations or with arsenic. Embedded in this array is a Tl site, and a Mn^2+ site, apical to the second array. The simplified formula based on structure refinement is Mn_{0.95}Ti_{1.00}Hg_{0.00}Pb_{0.00}Sb_{0.00}S_{48.00}As_{48.00}Pb_{0.00}S_{48.00}. Certain disagreement with chemical data is explained either by slightly distinct chemistry of the grains used for EMPA and SCXRD or by less perfect resolution of Sb/As and Sb/Pb + Sb/Ti distribution among the Sb sites. The mineral name honors Mikhail Vladimirovich Tsyganko (b. 1979), a mineral collector from city of Severouralsk, Northern Urals, Russia, and founder of the mineralogical museum in that city. He collected the specimens where the new mineral was discovered along with other specimens where new species vorontsovite and ferrovorontsovite were found. The type specimen is deposited in the Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia.
NEW MINERAL NAMES

Vorontsovskoe gold deposit, near the settlement of Vorontsovka, 13 km south of Krasnotur’insk city, North Urals, Russia. The specimens were found in 2016 at the ore stockpile. Earlier, the composition with Tl slightly dominant over Cs pfu, thus corresponding to vorontsovite, was reported (Chen and Szymański 1981) in one spot in the core of zonal galakhite crystal from the Getechel mine, Nevada, U.S.A. It was noted however that peak overlapping and the lack of suitable standards might affect the accuracy of the chemical data. Vorontsovskoe deposit is located in a volcanic-plutonic belt. Ore formation developed in several stages and represented by three main types of primary ores: sulfide-skarn ores, sulfide-silicate ores, and sulfide-carbonate ores. Both new minerals occur in the ores of the third type located in calcite-dolomite limestone breccias with subordinated quartz, feldspar, clinohloere, muscovite, accessory minerals (titanite, apatite, baryte, armenite, scheelite, gold), and sulfidic assemblage: abundant pyrite, realgar, stibnite, cinnabar, less common orpiment, Hg-sphalerite, and Zn–Mn-bearing metacinnabar; rare wakabayashiite and coloradoite. Thallium mineralization is represented by relatively common routhierite, dalnegroite-chabournéite nies are isostructural with galakhite, being its Tl- and Tl–Fe analogues, respectively, and forming together the galakhite group. Similarly to galakhite, the crystal structures of vorontsovite and ferrovorontsovite are represented by three independent crystallographic sites: Tl and Cs share large 12-fold coordinated cavities; As with Sb and Se are located at the top of a trigonal pyramids, the base of which is a triangle formed by S-anions; corner-sharing. The homovalent substitution Hg↔Fe, Zn→Hg is typical for many sulfosalts thus making possible the existence of potential Zn member of the group. Vorontsovite was named for its type locality, which name consequently honors the mining engineer Vladimir Vasilyevich Vorontsov (1842 – later than 1908). Ferrovorontsovite named as its Fe-analogue. The type specimens of both new minerals are deposited in the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. D.B.

Comments: A strong difference in accuracy of the electron probe data depend on the choice of emission lines, standards, beam focus, etc., was noted for galakhite (Chen and Szymański 1981; Pekov and Bryzgalov 2006). Particular, a defocused beam was used to avoid a sample damage. The new species were analyzed at 25 kV and 20 nA with a beam size of 1 µm. No data on the samples behavior under the beam provided. The difference in optical properties between galakhite and isostructural new minerals seems unusual. The reflectance value for galakhite is gradually decreasing from ~27 to ~20% with the wavelength increasing from ~470 to ~700 nm and further (Gruzdev et al. 1972), while for vorontsovite/ ferrovorontsovite these values are increasing from ~26/ 25 to ~30/ 29 % at the same interval. The reason for that might be in Tl behavior in the structure and deserves a special discussion.

References cited

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