

New Mineral Names*†

OLIVIER C. GAGNÉ¹, DMITRIY I. BELAKOVSKIY², FERNANDO CÁMARA³, YULIA UVAROVA⁴, AND LOUIS J. CABRI⁵

¹Department of Geological Sciences, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada

²Fersman Mineralogical Museum, Russian Academy of Sciences, Leninskiy Prospekt 18 korp. 2, Moscow 119071, Russia

³Dipartimento di Scienze della Terra “Ardito Desio”, Università di degli Studi di Milano, Via Mangiagalli, 34, 20133 Milano, Italy

⁴CSIRO Mineral Resources, CSIRO, ARRC, 26 Dick Perry Avenue, Kensington, Western Australia 6151, Australia

⁵Cabri Consulting Inc., 700-702 Bank Street, PO Box 14087, Ottawa, Ontario K1S 3V0, Canada

IN THIS ISSUE

This New Mineral Names has entries for 17 new minerals, including 6 new species of the sartorite homologous series: bernalottiite, écrinsite, enneasartorite, hendekasartorite, heptasartorite, and polloneite. Other new minerals are dzierżanowskite, ferhodsite, hansblockite, jaszczakite, juansilvaite, kravtsovite, magnesioacanuite, maneckiite, omariniite, přibramite, and richardsollite.

BERNARLOTTITE*, ÉCRINSITE*, ENNEASARTORITE*, HEPTASARTORITE*, HENDEKASARTORITE*, AND POLLONEITE*

- P. Orlandi, C. Biagioni, E. Bonaccorsi, Y. Moëlo, and W.H. Paar (2017) Lead-antimony sulfosalts from Tuscany (Italy). XXI. Bernalottiite, $Pb_{12}(As_{10}Sb_6)S_{16}S_{36}$, a new $N=3.5$ member of the sartorite homologous series from the Ceragiola marble quarry: occurrence and crystal structure. *European Journal of Mineralogy*, 29(4), 713–726.
- D. Topa, U. Kolitsch, E. Makovicky, and C. Stanley (2017) Écrinsite, $AgTi_3Pb_4As_{11}Sb_9S_{36}$, a new thallium-rich homeotype of baumhauerite from the Jas Roux sulphosalt deposit, Parc national des Écrins, Hautes-Alpes, France. *European Journal of Mineralogy*, 29(4), 689–700.
- D. Topa, E. Makovicky, B. Stoeger, and C. Stanley (2017) Heptasartorite, $Tl_7Pb_{22}As_{55}S_{108}$, enneasartorite, $Tl_6Pb_{32}As_{70}S_{140}$ and hendekasartorite, $Tl_2Pb_{48}As_{82}S_{172}$, three members of the anion-omission series of ‘sartorites’ from the Lengenbach quarry at Binntal, Wallis, Switzerland. *European Journal of Mineralogy*, 29(4), 701–712.
- E. Makovicky, D. Topa, and B. Stoeger (2018) The crystal structures of heptasartorite, $Tl_7Pb_{22}As_{55}S_{108}$, and enneasartorite, $Tl_6Pb_{32}As_{70}S_{140}$, two members of an anion-omission series of complex sulfosalts from Lengenbach, the Swiss Alps, and comparison with the structures of As–Sb sartorite homologues. *European Journal of Mineralogy*, DOI: 10.1127/ejm/2018/0030-2706
- D. Topa, F.N. Keutsch, E. Makovicky, U. Kolitsch, and W. Paar (2017) Polloneite, a new complex Pb(-Ag)-As-Sb sulfosalt from the Pollone mine, Apuan Alps, Tuscany, Italy. *Mineralogical Magazine*, 81(6), 1303–1322.

The new minerals bernalottiite (IMA2013-133), ideally $Pb_{12}(As_{10}Sb_6)S_{16}S_{36}$, écrinsite (IMA 2015-099), ideally $AgTi_3Pb_4As_{11}Sb_9S_{36}$, heptasartorite (IMA 2015-073), ideally $Tl_7Pb_{22}As_{55}S_{108}$, enneasartorite (IMA 2015-074), ideally $Tl_6Pb_{32}As_{70}S_{140}$, hendekasartorite (IMA 2015-075), ideally $Tl_2Pb_{48}As_{82}S_{172}$, and polloneite (IMA 2014-093), ideally $AgPb_{46}As_{26}Sb_{23}S_{120}$ are new members of the sartorite homologous series (Makovicky 1985, 1997), which have two known slab types based on the SnS archetype ($N=3$ and $N=4$, representing the number of polyhedra

across each of them). The variety of species is created by combinations of these two-unit homologue slabs (i.e., $N_{1-2}=3,4=3.5$) in different ratios. Bernalottiite and écrinsite have $N_{1,2}=3,4$, i.e., $N=3.5$, and share the same N value with baumhauerite, argentobaumhauerite and boscardinite. Polloneite is $N=4$ member with substantial Sb and small, but important, Ag content. Heptasartorite, enneasartorite, and hendekasartorite belong to the lowermost members of the series (all slabs with $N=3$). These species are the sulfur-omission series, with periodicity imperfections expressed as non-commensurate structures, and are referred to as “M-sartorites” where M stands for hepta-, ennea-, and hendeka (7, 9, and 11), or to AOD. In “M-sartorites,” antimony does not exceed 1–2 wt%. Silver is absent in them, in agreement with $N=3$.

Bernalottiite was found in a few specimens at the Ceragiola quarry, Seravezza, Apuan Alps, Tuscany, Italy. It was originally reported as “Sb-rich baumhauerite” (Orlandi et al. 1996; Orlandi and Criscuolo 2009). Further study revealed the presence of a $3 \times 7.9\text{Å}$ superstructure compare to baumhauerite and this Sb-rich derivative has been named bernalottiite. The mineral occurs in elongated, sometimes s-shaped cavities in the Early Jurassic marbles. The cavities of a few millimeters to few centimeters in width and up to 30 cm high with the length up to several meters are restricted to certain layers and contains a number of Pb–Sb–As sulfosalts including guettardite, robinsonite, izoklakeite, zinkenite, boulangerite, sartorite, semseyite, and jordanite. Seravezza is also the type locality for moëloite and disulfodadsonite. The origin of these minerals is related to the circulation of hydrothermal fluids during the Tertiary Alpine tectonometamorphic event. Bernalottiite is closely associated with Sb-rich sartorite (not fully identified yet). The mineral forms lead-gray acicular by [010] crystals up to 1 mm in length and few micrometers in width, with a black streak and a metallic luster. It is brittle without any evident cleavage. Hardness and density were not measured due to a small size; $D_{\text{calc}} = 5.601 \text{ g/cm}^3$ (for an ideal formula). In plane-polarized light, bernalottiite is white with abundant red internal reflections. Pleochroism in shades of gray-blue is weak in air and is distinct in oil. Birefractance is distinct. Between crossed polars, bernalottiite is distinctly to strongly (in oil) anisotropic, with grayish to bluish rotation tints. Reflectance data was obtained in 400–700 nm interval and are similar but still differs from that of boscardinite. The values for the COM wavelengths (% in air) are [$R_{\text{min}}/R_{\text{max}}$, nm]: 30.0/37.5, 470; 30.3/37.3, 546; 29.7/36.8, 589; 29.3/36.2, 650. Electron-microprobe WDS analyses, collected on two different grains are [wt% (range)]: Cu 0.09 (0–0.27), Pb 48.89 (47.48–49.92), As 17.48 (17.25–17.68), Sb 11.36 (11.29–11.47), S 23.11 (22.85–23.47), total 100.93 (3 analy-

* All minerals marked with an asterisk have been approved by the IMA CNMNC.

† For a complete listing of all IMA-validated unnamed minerals and their codes, see <http://pubsites.uws.edu.au/ima-cnmmc/>.

ses) and Pb 47.43 (47.24–47.88), As 14.56 (14.31–14.92), Sb 13.92 (13.69–14.12), S 22.64 (22.37–22.81), total 98.56 (5 analyses). On the basis of $\Sigma Me = 28$ apfu, the chemical formulae are $Cu_{0.07}Pb_{11.71}As_{11.59}Sb_{4.63}S_{35.78}$ and $Pb_{11.92}As_{10.12}Sb_{5.95}S_{36.76}$. The strongest lines in the X-ray powder-diffraction pattern [$d \text{ \AA}$ ($I_{\text{relative visual}}$: hkl)] are: 3.851 (s; 006), 3.794 (s; $\bar{3}06, \bar{6}03$), 3.278 (s; $4\bar{2}3, 423$), 3.075 (s; 606), 2.748 (vs; $426, 4\bar{2}6$), 2.363 (s; $820, 8\bar{2}0$), 2.221 (vs; $\bar{3}29, \bar{1}29$, multiple). Due to the very small size of available crystals, intensity data were collected at the XRD1 beamline at the Elettra synchrotron radiation facility, Basovizza, Trieste, Italy. The crystal structure was solved by direct methods and refined to $R_1 = 0.088$ for 7317 $F_o > 4\sigma(F_o)$ reflections. It shows a triclinic unit cell, space group $P\bar{1}$, $a = 23.704(8)$, $b = 8.386(2)$, $c = 23.501(8)$ \AA, $\alpha = 89.91(1)$, $\beta = 102.93(1)$, $\gamma = 89.88(1)$, $V = 4553 \text{ \AA}^3$, $Z = 3$. Bernarlottiite crystal structure can be described as being formed by 1:1 alternation of sartorite-type ($N = 3$) and dufrénoysite-type ($N = 4$) layers along c , connected by Pb atoms with tricapped trigonal prismatic coordination. Each layer results from the stacking of two types of ribbons along a , a centrosymmetric one alternating with two acentric ones. The three main building operators of the structure are: (1) the interlayers As-vs.-Pb crossed substitution, stabilizing the combined $N = (3, 4)$ baumhauerite homologue, (2) the inter-ribbon Sb partitioning in the sartorite-type layer, with “symmetrization” of the Sb-rich ribbon, that induces the $3a$ superstructure, and (3) the common (As, Sb) polymerization through short (As,Sb)–S bonds. The name honors Bernardino Lotti (1847–1933) for his significant contribution to the knowledge of the geology of Tuscany and to the development of the Tuscan mining industry. The holotype specimen is deposited in the Museo di Storia Naturale, Università di Pisa, Italy.

Écrinsite is found in the Jas Roux As–Sb–Pb–Tl–Hg–Ag deposit, Parc national des Écrins, Département des Hautes-Alpes, France. The deposit is situated in a Triassic metasedimentary series. The mineralization sequence comprises a multiple stages and is believed to have been caused by low-temperature hydrothermal fluids of Triassic age with some role of an Alpine, Tertiary remobilization. Associated minerals are jasrouxite, stibnite, smithite, guettardite, chabournéite, pierrotite, and As-bearing zinkenite. Écrinsite forms anhedral crystal aggregates up to 1.5 mm. The mineral is dark gray, opaque with black streak and metallic luster. It is brittle without any discernible cleavage and with conchoidal fracture. The micro-indentation hardness $VHN_{25} = 189$ (175–201) kg/mm² corresponding to 3–3½ of Mohs scale. $D_{\text{calc}} = 4.96$ g/cm³. In reflected light it is white, without internal reflections. Pleochroism is not discernible. In crossed polarizers, anisotropism is distinct, with rotation tints in shades of gray. The reflectance values for the COM wavelengths (% air) [$R_{\text{min}}/R_{\text{max}}$, nm] are: 37.3/38.6, 470; 35.2/36.7, 546; 34.0/35.5, 589; 32.0/33.3, 650. The average of 20 electron probe WDS analysis is [wt% (standard deviation)]: Ag 2.03(10), Cu 0.02(1), Tl 14.57(20), Pb 16.23(32), Sb 23.97(25), As 17.87(17), S 25.20(15), total 99.88. The empirical formula calculated on the basis of $28Me + 36S = 64$ apfu is: $Ag_{0.87}Cu_{0.02}Tl_{3.28}Pb_{3.61}Sb_{9.06}As_{10.98}S_{36.19}$. The strongest lines in the X-ray powder-diffraction pattern [$d \text{ \AA}$ ($I\%$; hkl)] are: 4.14 (68; $\bar{1}05$), 3.72 (92; $105, \bar{1}\bar{1}5$), 3.56 (100; $106, \bar{2}\bar{1}2$), 3.53 (80; 122), 3.48 (72; 122). The single-crystal ($0.015 \times 0.04 \times 0.07$ mm in size) X-ray diffraction data refined to $R_1 = 0.0526$ for 6199 unique observed $F_o \geq 4\sigma(F_o)$ reflections shows écrinsite is triclinic, space group $P\bar{1}$, $Z = 1$; $a = 8.080(2)$, $b = 8.533(2)$, $c = 22.613(4)$ \AA, $\alpha = 90.23(3)$, $\beta = 97.17(3)$, $\gamma = 90.83(3)^\circ$, $V = 1546.7 \text{ \AA}^3$. The structure of écrinsite contains 14 independent metal and 18 distinct sulphur sites. There are five fully occupied sites (Tl, Pb₄, Sb₁, Sb₂, and As₄) and nine mixed sites of which four are split: (Tl,Pb)₂, (Pb₃, Sb), (Sb,As)₇, and (As,Ag)₁₀. The Sb₁ site is associated to As₄ and S₁ and S₉ sites, in a long and short Sb₁–S distance pair, suggesting a weak amount of possible flipping of the Sb₁ atom between two alternative bond schemes. This results in a (poorly defined) diagonally orientated three-cation crankshaft chain. The name is for the Parc national des Écrins where the type locality (Jas Roux) is located. The holotype is deposited in the Naturhistorisches Museum, Wien, Austria.

Heptasartorite, enneasartorite, and hendekasartorite occur at the Lenggenbach deposit, Binntal (Valais, Switzerland), in a dolomite gangue, which is the type locality for almost 40 new mineral species (of which 24 are thallium-based minerals) and is the most prolific locality worldwide for sulfosalts and sulfide minerals. Heptasartorite was found so far in two specimens only while enneasartorite and hendekasartorite are common among 232 of the investigated samples. M-sartorites are among the latest sulfosalts minerals, overgrowing but especially replacing the earlier phases. Enneasartorite can be replaced by heptasartorite. All M-sartorite can overgrow and replace baumhauerite and rathite aggregates as well as practically all other sartorite homologues present in the deposit. Heptasartorite, enneasartorite, and hendekasartorite are all indistinguishable being lead gray, opaque, with dark brown streak and metallic luster. All are brittle with good {100} cleavage and no parting. The fracture is conchoidal. The micro-indentation hardness $VHN_{25} = 202$ (194–211), 206 (199–213), and 214 (208–221) kg/mm² for hepta-, ennea-, and hendekasartorite respectively corresponding to 3–3½ of Mohs scale for all of them. The density of all three minerals was not measured because of paucity of available material and intergrowths. D_{calc} values are (in the same sequence) 4.9, 5.1, and 5.18 g/cm³ using the simplified formulae. The three minerals show very similar optical qualitative properties in reflected light being grayish-white, with rare deep red internal reflections. Pleochroism and birefractance are weak; anisotropism is moderate to weak, in brown-violet and deep green tones. Both the maximum and minimum reflectance values increase slightly from heptasartorite to hendekasartorite, but cannot be used as diagnostic tool (grain orientation will have greater influence than this difference). The reflectance values for the COM wavelengths (% air) [$R_{\text{min}}/R_{\text{max}}$, nm] for hepta-, ennea-, and hendekasartorite are: 36.0/40.0, **36.7/39.7**, 37.2/40.6, 470; 33.5/37.5, **34.0/37.2**, 35.3/38.5, 546; 31.7/35.3, **32.4/35.4**, 33.9/36.8, 589; 29.6/32.8, **30.2/32.8**, 31.5/34.0, 650. Polysynthetic twinning is very common in heptasartorite.

Heptasartorite. The average of 15 electron probe WDS analysis on three grains is [wt% (standard deviation)]: Tl 10.98(23), Pb 32.83(37), Sb 1.18(10), As 29.72(21), S 25.44(17), total 100.15. The empirical formula calculated on the basis of 192 apfu is $Tl_{7.30}Pb_{21.55}(As_{53.94}Sb_{1.31})_{\Sigma 55.25}S_{107.90}$ $\Sigma Me = 84.10$. The simplified formula, $Tl_7Pb_{22}(As_54Sb)_{\Sigma 55}S_{108}$ is derived from the sevenfold superstructure of “ideal sartorite” (i.e., $7 \times Pb_4As_8S_{16} = Pb_{28}As_{56}S_{112}$), by a combination of sulfur omission with appropriate changes in cation ratios. Ideally, omission of 4 S pfu entails replacement of 8 Pb atoms of the “ideal” formula by 8 Tl giving $Tl_8Pb_{20}As_{56}S_{108}$. Substitution of a part of As by Pb as means of vacancy charge compensation yields the ideal formula $Tl_7Pb_{22}As_{55}S_{108}$. The strongest lines in the X-ray powder-diffraction pattern [$d \text{ \AA}$ ($I\%$; hkl)] are: 9.84 (72; 002), 3.86 (59; 021), 3.52 (100; 015), 3.46 (51; 711), 2.955 (75; $\bar{7}15$), 2.952 (58; 713), 2.752 (73; $\bar{7}23$), and 2.752 (73; 721). The single-crystal ($0.09 \times 0.08 \times 0.05$ mm in size) X-ray diffraction data refined to $R_1 = 0.0522$ for 6926 reflections with $F_o > 4\sigma(F_o)$, and 0.0925 for all 10913 reflections, shows heptasartorite is monoclinic, space group $P2_1/c$, $Z = 1$; $a = 29.269(2)$, $b = 7.8768(5)$, $c = 20.128(2)$ \AA, $\beta = 102.065(2)^\circ$, $V = 4537.8 \text{ \AA}^3$.

Enneasartorite. The average of 12 electron probe WDS analysis on three grains is [wt% (standard deviation)]: Tl 7.44(11), Pb 37.17(38), Sb 1.09(31), As 28.99(25), S 25.42(18), total 100.12. The empirical formula calculated on the basis of $108Me + 140S = 248$ apfu is $Tl_{6.42}Pb_{31.68}(As_{68.31}Sb_{1.59})_{\Sigma 69.90}S_{140.00}$, $\Sigma Me = 107.99$. The simplified formula, $Tl_6Pb_{48}As_{82}S_{172}$ is derived from the ninefold superstructure of “ideal sartorite” (i.e., $9 \times Pb_4As_8S_{16} = Pb_{36}As_{72}S_{144}$), by a combination of sulfur omission with appropriate changes in cation ratios. Ideally, omission of 4 S pfu entails replacement of 8 Pb atoms of the “ideal” formula by 8 Tl giving $Tl_8Pb_{28}As_{72}S_{140}$. However, the Pb ↔ As substitution covers a part of compensation process; it consumes 1.6 As, cancelling a need for 1.6 Tl, giving $Tl_{6.4}Pb_{31.2}As_{70.4}S_{140}$. The strongest lines in the X-ray powder-diffraction pattern [$d \text{ \AA}$ ($I\%$; hkl)] are: 9.82 (67; 002), 3.86 (63; 021), 3.51 (100; 015), 3.46 (51; 911), 2.953 (61; 913), 2.949 (76;

$\bar{9}15$), 2.752 (71; 921), 2.751 (73; $\bar{9}23$). The single-crystal ($0.10 \times 0.05 \times 0.04$ mm in size) X-ray diffraction data refined to $R_1 = 0.065$ for 5862 $F_o > 4\sigma(F_o)$ reflections, and 0.0933 for all 8301, shows enneasartorite is monoclinic, space group $P2_1/c$; $Z = 1$; $a = 37.612(6)$, $b = 7.8777(12)$, $c = 20.071(3)$ Å, $\beta = 101.930(2)^\circ$, $V = 5818.6$ Å³.

Hendekasartorite. The average of 22 electron probe WDS analysis on five grains is [wt% (standard deviation)]: Tl 7.80(15), Pb 44.63(20), Sb 0.90(6), As 27.10(14), S 24.83(13), total 100.26. The empirical formula calculated on the basis of $132Me + 172S = 304$ apfu is $Tl_{3.03}Pb_{47.71}(As_{80.10}Sb_{1.65})_{\Sigma 81.74}S_{171.52}$, $\Sigma Me = 132.48$. The simplified formula, $Tl_3Pb_{48}As_{82}S_{172}$, is derived from the 11-fold superstructure of “ideal sartorite” (i.e., $11 \times Pb_4As_8S_{16} = Pb_{44}As_{88}S_{176}$), by a combination of sulfur omission with appropriate changes in cation ratios. The omission of 4S pfu can be achieved by two mechanisms: replacement of 8 As atoms of the “ideal” formula by 8 Pb giving $Pb_{52}As_{80}S_{172}$; replacement of 8 Pb atoms by 8 Tl giving $Tl_8Pb_{36}As_{88}S_{172}$. Combination of both mechanism yields $Tl_3Pb_{46}As_{83}S_{172}$, close to the above empirical formula. The strongest lines in the X-ray powder-diffraction pattern [d Å ($P\%$; hkl)] are: 9.76 (56; 202); 3.87 (69; 121); 3.50 (100; 515); 3.46 (51; $\bar{8}13$); 2.947 (66; $\bar{1}0.1.1$); 2.941 (76; $\bar{2}19$); 2.753 (73; 823); and 2.751 (73; 427). The single-crystal X-ray diffraction data refined to $R_1 = 0.066$ shows hendekasartorite is monoclinic, space group $P2_1/c$, $Z = 1$; $a = 31.806(5)$, $b = 7.889(12)$, $c = 28.556(4)$ Å, $\beta = 99.034(2)^\circ$, $V = 7076.4$ Å³.

The structures of all three minerals are typical for the $N = 3$ member of the sartorite homologous series, with the three-polyhedron-wide double ribbons which include trigonal prismatic Pb(Tl) positions on the margins and As-rich portions more concentrated in the ribbon interior. Strong bonds to sulfur, especially those of As, are mostly oriented into the volume of a double-ribbon, whereas the lone-electron pairs of As point into the inter-ribbon space. All three structures show the presence of short diagonal crankshaft chains of (especially) short As–S bonds. These chains are stacked along the $4.2\text{-}\bar{A}$ direction, giving the $M \times 4.2\text{-}\bar{A}$ superstructures of the idealized “basic sartorite motif.” The sevenfold superstructure of heptasartorite is based on a sequence of crankshaft chains: a W-shaped chain with five As and one mixed coordination polyhedron in which As and a large cation combine; a 4-member chain; a pair of As polyhedra; and two isolated As polyhedra. In the ninefold structure of enneasartorite, one more 4-member chain of As polyhedra has been added, making the environment of the W-shaped chain symmetric. One of the isolated As polyhedra becomes a mixed-cation site. In both structures, the S site chelated by the As atoms of the W-shaped chain becomes vacant, generating the anion-omission derivatives of the ideal $PbAs_2S_4$ motif. The chain motifs differ from those in the Sb–As homologues of sartorite, which display only twofold superstructures. Naming of minerals refers to the M value: heptasartorite has a sevenfold superstructure based on the $4.2\text{-}\bar{A}$ subcell; enneasartorite has ninefold superstructure; and hendekasartorite has 11-fold superstructure. Type materials are deposited in the Naturhistorisches Museum Wien, Austria.

Polloneite was found at the sterryite/parasterryite occurrence in the Pollone mine exploring Pollone baryte-pyrite-(Pb-Zn-Ag) deposit at Valdicastello Carducci, Apuan Alps, Tuscany, Italy. Host rocks here consist of a siliciclastic formation which underwent Tertiary syn-kinematic greenschist metamorphism ~ 350 °C and 0.35 GPa. Fluid circulations concentrated along shear zones, leading to vein-like baryte-pyrite-Pb-Zn-Ag sulfide mineralization at the temperature up to 450 °C. Polloneite forms rare prismatic crystals up to 0.5 mm long and 0.3 mm wide enclosed in the baryte. The crystals have complex morphology but no visually observable twinning. Polloneite is gray-black and opaque with a black streak and metallic luster. It is brittle, with no cleavage or parting, and exhibits a conchoidal fracture. The micro-indentation hardness $VHN_{50} = 200$ (185–211) kg/mm² corresponding to 3–3½ of Mohs scale. The density was not measured due to the paucity of material; $D_{calc} = 5.77$ g/cm³. In reflected light polloneite is white, with moderate birefractance, no visible pleochroism and no internal reflections. Anisotropism is

moderate in brown-violet and deep gray shades. The reflectance values for the COM wavelengths (in air) [$R_{max}/R_{min}\%$, nm] are 42.4/30.2, 470; 41.0/28.8, 546; 39.8/27.9, 589; 37.4/26.0, 650. The averaged 15 point WDS electron probe analyses is [wt% (St.dev.)]: Ag 0.71(5), Pb 52.05(21), As 10.61(22), Sb 15.40(12), S 21.16(8), total 99.92 wt%. The empirical formula is $Ag_{1.20}Pb_{45.76}(As_{25.79}Sb_{23.04})_{\Sigma 48.83}S_{12.21}$ based on 216 ($Me+S$) apfu. The strongest lines of the calculated powder X-ray diffraction pattern are [d_{calc} Å ($I_{rel}\%$; hkl)]: 3.795 (100; 026); 3.414 (60; 233); 3.238 (69; 080); 3.020 (97; 253); 2.922 (82; 066); 2.738 (73; $\bar{2}36$); 2.375 (79; 290), 2.103 (64; 400). Polloneite is monoclinic, $P2_1$, $a = 8.413(2)$, $b = 25.901(5)$, $c = 23.818(5)$ Å, $\beta = 90.01(3)^\circ$, $V = 5189.8(18)$ Å³, and $Z = 1$. The crystal structure of polloneite was solved by direct methods and refined to $R = 4.7\%$. It has a threefold superstructure with a tripled unit-cell parameter, 7.9 Å, of sartorite homologues. The crystal structure is based on the As-Sb-rich slabs, in which several types of crankshaft chains and isolated (As,Sb)–S polyhedra occur. A sequence of three different, tightly bonded double-layer fragments (broad ribbons) contains two asymmetric fragments with long crankshaft chains, whereas the third fragment type, with Ag, contains small mirror-symmetrical metalloid groups and no crankshaft chains. This configuration can potentially cause order-disorder phenomena in the structure. Polloneite is distinguished from veenite and dufrénoysite, by the threefold superstructure and the mixed As-Sb character, respectively. The mineral is named after the Pollone mine where it was discovered. The holotype specimen of polloneite is deposited in the Naturhistorisches Museum, Vienna, Austria. **F.C., D.B., Yu.U.**

References cited

- Makovicky, E. (1985) The building principles and classification of sulphosalts based on the SnS archetype. *Fortschritte der Mineralogie*, 63, 45–89.
 ——— (1997) Modular crystal chemistry of sulphosalts and other complex sulphides. Chapter 3. EMU Notes in Mineralogy, 1, 237–271.
 Orlandi, P., and Criscuolo, A. (2009) Minerali del marmo delle Alpi Apuane. Pacini Editore, Pisa, 180 p.
 Orlandi, P., Del Chiaro, L., and Pagano, R. (1996) Minerals of the Seravezza marble, Tuscany, Italy. *Mineralogical Record*, 27, 47–58.

DZIERŻANOWSKITE*

I.O. Galuskina, E.V. Galuskin, K. Prusik, Y. Vapnik, R. Juroszek, L. Ježak, and M. Murashko (2017) Dzierżanowskite, $CaCu_2S_2$ —a new natural thiocuprate from Jabel Harmun, Judean Desert, Palestine Autonomy, Israel. *Mineralogical Magazine*, 81(5), 1072–1085.

Dzierżanowskite (IMA 2014-032), ideally $CaCu_2S_2$, was discovered in pyrometamorphic rocks of the Hatrurim Complex (“Mottled Zone”), on Jabel Harmun (Jabel means mountain in Arabic), near the Palestinian village of Nabi Musa, which is close to a historical place situated in the Judean Desert, West Bank, Palestinian Autonomy, Israel. Dzierżanowskite was also later discovered in jasmundite-rich apoflamite rocks at Jabel Harmun. The new mineral forms inhomogeneous, separate grains 10–15 µm in size and intergrowths with chalcocite, covellite, anilite, djurleite, and oldhamite. Other minerals present in the holotype specimen are larnite, ye’elimite, fluorellestadite, brownmillerite, later-formed ternesite, nabimusaite, jasmundite and Ca, Cu, Fe, Ni, Ag sulfides, and accessory vapnikite, vorlanite, periclase, shulamite, magnesioferrite-spinel, gehlenite, pyrrhotite, and baryte. In the sample of apoflamite rock found in 2015, rare dzierżanowskite and oldhamite build complex mineral aggregates together with later-formed brownmillerite, fluorellestadite, and Cu-sulfides. Small zones of chalcocite or covellite occur between dzierżanowskite and jasmundite, and other Ca, Cu, Fe, Ni, Ag sulfides and, rarely, exotic K and Na sulfides, particular the Na-analogue of murunskite. Dzierżanowskite is dark orange, has a creamy streak and submetallic luster. The density was not measured due to very small crystal size; $D_{calc} = 4.391$ g/cm³. In reflected light, it is gray with a cream tint and characteristic yellow-orange internal reflections.

Dzierżanowskite shows strong orange cathodoluminescence; partially hydrated dzierżanowskite grains have weak yellowish cathodoluminescence. The Raman spectrum of dzierżanowskite has the bands (cm^{-1}): 300 (Cu-S stretching vibrations); 103 and 86 (Ca-S stretching vibrations). The average of nine WDS analyses is [wt% (range)]: Cu 55.25 (54.26–55.93), Fe 0.13 (0.00–0.30), S 27.46 (27.24–27.64), Ca 16.99 (16.73–17.37), total 99.83% (for the holotype sample), and the average of 3 WDS analyses on the cotype sample (wt%) is: Cu 55.78, Fe 0.13, S 27.81, Ca 16.52, total 100.24 wt%. The empirical formulae based on 5 (*Me*+S) apfu are: $\text{Ca}_{0.98}\text{Cu}_{2.02}\text{Fe}_{0.01}\text{S}_{1.99}$ and $\text{Ca}_{0.95}\text{Cu}_{2.03}\text{Fe}_{0.01}\text{S}_{2.01}$ respectively. Due to the scarcity of material the powder X-ray diffraction data was not collected and the pattern was calculated on the basis of the single-crystal structure refinement of synthetic CaCu_2S_2 . The strongest lines in the calculated powder X-ray diffraction pattern are [d_{calc} Å ($I_{\text{rel}}\%$; hkl): 2.358 (100; 102), 1.970 (93; 110), 3.023 (78; 011), 6.523 (36; 001), 3.412 (28; 100), 1.834 (28; 103)]. The mineral is commonly partially oxidized, which prohibited finding a proper single crystal for structural work. Structural data were collected using EBSD, and the structure was refined based on a model for synthetic CaCu_2S_2 . Dzierżanowskite is trigonal, $P\bar{3}m1$, $a = 3.9400(4)$, $c = 6.523(1)$, $V = 87.69 \text{ \AA}^3$, $Z = 1$. The composition, EBSD pattern and Raman spectrum all confirm that dzierżanowskite is the natural analog of synthetic CaCu_2S_2 , and belongs to a group of thiocuprates that have a CaAl_2Si_2 structure type. The crystal structure is based on double tetrahedral layers formed by CuS_4 edge-linked tetrahedra and layers of Ca octahedra in between the tetrahedral layers. The name honors Piotr Dzierżanowski (1947–2015) (Institute of Geochemistry, Mineralogy and Petrology, University of Warsaw, Poland) who first identified natural CaCu_2S_2 in 2012 in one of the sample of larnite rocks, number MII-33 (from M. Murashko collection) (holotype specimen). A fragment of the holotype, specimen no. MII-33 is deposited in the Mineralogical Museum, University of Wrocław, Poland. **Yu.U.**

Comment: No reflectance values given, nor the explanation why it was not obtained.

FERHODSITE*

V.D. Begizov and E.N. Zavjalov (2016) Ferhodsit (Fe,Rh,Ir,Ni,Cu,Co,Pt) $_{9-x}\text{S}_8$ —new mineral from Nizhny Tagil ultramafic complex. *Novye Dannye o Mineralakh* (New Data on Minerals), 51, 8–11 (in Russian with English abstract).

The new mineral ferhodsit (IMA 2009-056), ideally (Fe,Rh,Ni,Ir,Cu,Co,Pt) $_{9-x}\text{S}_8$ (abstract) or (Fe,Rh,Ir,Ni,Cu,Co,Pt) $_{9-x}\text{S}_8$ (title and text) was discovered in mineral separates from dunite of the Solov'yova Gora (central part of the Nizhny Tagil ultramafic massif), Urals, Russia, and in a heavy mineral concentrate from the Konder placer deposit, Ayano-Mayaskiy region, Khabarovskiy kray, Russia. The mineral is usually observed as isometric or platy, triangular, and corroded grains located along periphery of isoferroplatinum grains. Commonly, the new mineral is mantled and corroded by chengdeite and a solid solution that is intermediate in composition between isoferroplatinum and tetraferroplatinum. Other minerals observed in intergrowths with ferhodsit are cooperite, cuproiridsit, bowieite, and kashinit (laurite and erlichmanite are also mentioned, but only in the English version of the abstract). Opal commonly penetrates along well-developed {111} cleavage fractures in ferhodsit grains varying in size from a few to 100 μm with a mean of 30–40 μm (text); size of grains 10–50 μm and size of aggregates 40–70 or 100 μm (abstract). Ferhodsit has a black streak, metallic luster, in reflected light opaque, and light brownish-gray (English abstract) but also “grayish-creamy with a brownish tint” in Russian text. The micro-indentation hardness $\text{VHN}_{20} = 516(15) \text{ kg/mm}^2$. The density was not measured; $D_{\text{calc}} = 7.186 \text{ g/cm}^3$ (without specifying a composition). Under reflected light the mineral appears brownish gray with very weak bireflectance and weak to moderate anisotropism (gray colors with a cream tint). Internal

reflections and pleochroism were not observed. The reflectance values with a 20 nm interval vary from 36.8% (700 nm) to 37.5% (400 nm) for ferhodsit and from 32.8% (700 nm) to 33.8% (400 nm) for the Ir-rich variety described as “Ir ferhodsit.” The values for the COM wavelengths [$R_{\text{max}}/R_{\text{min}}$ (nm)] are: 35.6/33.0 (470), 36.0/33.8 (546), 36.2/34.0 (589), 37.1/34.8 (650) for ferhodsit, and 30.0/27.0 (470), 31.3/27.5 (546), 31.3/28.3 (589), 32.0/29.3 (650) for “Ir ferhodsit.” The empirical formulae based on 17 apfu are given in the paper separately for each of 19 analyses. The Fe content varies from 2.82 to 3.99 apfu; Rh 0.18–2.68, Ir 0–2.12, Ni 0.50–1.96, Cu 0–1.64, and S 7.98–8.05 apfu. The powder X-ray diffraction data of ferhodsit are generally similar to those of pentlandite, however differs by an observed displacement or presence in ferhodsit of some lines and by several doublets. The selected lines of the ferhodsit X-ray powder diffraction pattern [d Å ($I\%$; hkl)] are (lines absent or significantly differ in position or/and intensity compare to pentlandite are in bold): 5.72 (50; 111), 3.01 (70; 311), **2.97 (20; 113)**, **2.81 (30; 302)**, **2.74 (203; <10)**, **2.60 (213; <10)**, **2.50 (20; 400)**, **2.23(100; 402)**, **2.21 (30; 204)**, 1.933 (60, 105), **1.772 (40; 440)**, **1.367 (30; 614)**, 1.167 (40; 803). The data was refined in a tetragonal unit-cell with $a = 10.009(5)$ and $c = 9.840(8) \text{ \AA}$, $V = 985.78 \text{ \AA}^3$, $Z = 4$, space group $P4_2/n$ (or, possibly, $P4/nmm$). The mineral is named after its two main elements but the Ir-rich compositions are referred to as “Ir ferhodsit.” The type specimen is deposited in the Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia.

Comments and discussion. The published description contains several discrepancies between the data given in the title, abstract and in the paper itself as well as between the text and d -spaces in Table 3. Cell parameters in the abstract are given to 3 significant figures and to 2 in the text. Totals for analyses #2, 4, 15, and 19 in Table 2 are not correct. Significantly, the authors do not discuss or group the analyses that range widely and do not specify which particular data were used for the calculated density. The average of 15 analyses (14 from Nizhny Tagil and 1 from Konder) is [wt% (range)]: Ir 14.1 (0–29.6). Rh 22.3 (12.4–31.9), Pt 2.1 (0–14.5), Fe 19.2 (17.3–22.5), Ni 7.7 (2.8–11.2), Cu 5.0 (0.0–9.6), Co 2.6 (0–4.8), S 27.1 (25.9–29.7), total 101.1 for ferhodsit (Rh > Ir pfu) and of 4 analyses of “Ir ferhodsit” (Ir > Rh pfu) from Nizhny Tagil: Ir 32.7 (26.0–37.9), Rh 7.1 (1.7–12.5), Pt 0.8 (0–2.1), Fe 18.1 (14.8–21.4), Ni 7.5 (4.4–10.7), Cu 8.2 (4.8–10.0), Co 1.7 (0–3.7), S 24.2 (23.4–25.0), total 100.1. The empirical formulae based on 17 apfu for the average compositions are accordingly: $(\text{Fe}_{3.35}\text{Rh}_{2.11}\text{Ni}_{1.28}\text{Cu}_{0.77}\text{Ir}_{0.72}\text{Co}_{0.43}\text{Pt}_{0.11})_{\Sigma 8.77}\text{S}_{8.24}$ ($D_{\text{calc}} = 6.573 \text{ g/cm}^3$) and $(\text{Fe}_{3.43}\text{Ir}_{1.80}\text{Cu}_{1.36}\text{Ni}_{1.35}\text{Rh}_{0.73}\text{Co}_{0.31}\text{Pt}_{0.04})_{\Sigma 9.02}\text{S}_{7.98}$ ($D_{\text{calc}} = 7.143 \text{ g/cm}^3$). Additionally, the deposited type specimen mentioned in the paper (catalogue #93467) considered as holotype is actually the Ir-rich variety but another one (catalogue #93468), considered as co-type (not mentioned in the paper) is an Rh-rich variety (Dmitriy Belakovskiy, pers. comm., 2017). The only reference in the paper is a now dated mineralogy textbook and the only discussion to related minerals is to pentlandite analyses, nor is there any discussion of the pentlandite structure and ionic radii of substituting elements. There is also no mention of a compositionally similar mineral reported from Ethiopia (Cabri et al. 1981) (UM1981-08-E:FeIrPtRhRu) in the IMA list of valid unnamed minerals <http://pubsites.uws.edu.au/ima-cnmc/Valid2012.pdf> (Smith and Nickel 2007) and another one from the UG-2 chromitite of Bushveld Complex, South Africa (Junge et al. 2014). Another relevant Rh-bearing Ni-Fe sulfide with 24 to 31% Rh reported recently (after the abstracted paper published) from the Coldwell Complex (Ontario) (Good et al. 2017). The names ferhodsit and Ir-ferhodsit are unfortunate since there are clearly compositions with Rh > Ir, Ir > Rh, Ni > Ir or Rh, and Cu > Ir where Fe varies (apfu) from 2.909 to 3.989 for Ir > Rh and from 2.997 to 3.767 for Rh > Ir. There is no evidence that any of these elements occur in specific structural positions, thus there is not enough data to consider whether ferhodsit is actually a single mineral

species or several different species. Similarly, one does not know which particular grain was used for reflectance measurements. Criddle and Stanley (1993) include reflectance data for several related minerals, but one is unable to further evaluate the mineral based on the ferrosite published information. **L.J.C.**

References cited

- Cabri, L.J., Criddle, A.J., Laflamme, H.H.G., Bearne, G.S., and Harris, D.C. (1981) Mineralogical study of complex Pt-Fe nuggets from Ethiopia. *Bulletin Minéralogique*, 104, 508–525.
- Criddle, A.J., and Stanley, C.J. (1993) Quantitative Data File for Ore Minerals, pp. 635. Chapman and Hall, London.
- Good, D.J., Cabri, L.J., and Ames, D.E. (2017) PGM facies variations for Cu-Pd deposits in the Coldwell Alkaline Complex, Ontario, Canada. *Ore Geology Reviews*, 90, 748–771.
- Junge, M., Oberthür, T., and Melcher, F. (2014) Cryptic variation of chromite chemistry, platinum-group element and platinum group mineral distribution in the UG-2 chromitite: an example from the Karee mine, Western Bushveld Complex, South Africa. *Economic Geology*, 109, 795–810.
- Smith, D.G.W., and Nickel, E.H. (2007) A system of codification for unnamed minerals: Report of the Subcommittee for Unnamed Minerals of the IMA Commission on New Minerals, Nomenclature and Classification. *Canadian Mineralogist*, 45, 983–1055.

HANSBLOCKITE*

H.-J. Förster, L. Bindi, C.J. Stanley, and G. Grundmann (2017) Hansblockite, $(\text{Cu,Hg})(\text{Bi,Pb})\text{Se}_2$, the monoclinic polymorph of grundmannite: a new mineral from the Se mineralization at El Dragón (Bolivia). *Mineralogical Magazine*, 81(3), 629–640.

Hansblockite (IMA2015-103), with simplified formula $(\text{Cu,Hg})(\text{Bi,Pb})\text{Se}_2$, is a new mineral discovered at the El Dragón mine, Cordillera Oriental, SW Bolivia. It was found in the almost vertical hydrothermal sulfide-selenide vein (ranging mostly from 0.5–2 cm in thickness) in the center of a 1.5 m wide shear zone cutting through a series of thinly stratified, pyrite-rich black shales and reddish-gray, hematite-bearing siltstones of probably Devonian age. The new mineral is intergrown with two unnamed Cu–Hg–Pb–Bi–Se species in association with umangite klockmannite, watkinsonite, eldragónite, eskebornite, clausenthalite, Co-rich penroseite and petrovicite. Hansblockite typically occurs as thin subparallel plates but locally form subhedral to anhedral grains up to $200 \times 50 \mu\text{m}$ in size. Crystals are black with black streak, opaque with metallic luster, are brittle with an irregular fracture and show no obvious parting and cleavage. The mineral is non-fluorescent. The microindentation hardness $\text{VHN}_{20} = 42$ (37–50) kg/mm^2 (Mohs hardness 2–2½). Density was not measured because of the small grain size; $D_{\text{calc}} = 8.26 \text{ g/cm}^3$. In the plane-polarized incident light hansblockite is cream to light gray, weakly bireflectant and weakly pleochroic from grayish cream to cream. No internal reflection was detected. Under crossed polars, it is weakly anisotropic with khaki to pale blue rotation tints. Reflectance values were measured between 400 and 700 nm in 20 nm intervals. The values for COM wavelengths [R_{min} , R_{max} % (nm)] are: 47.3, 48.1 (470); 47.4, 49.9 (546); 47.1, 49.0 (589); 46.6, 48.5 (650) in air. The average of 28 electron probe WDS analyses is [wt% (range)]: Cu 9.31 (8.14–10.01), Ag 0.73 (0.42–1.29), Hg 11.43 (11.00–12.23), Pb 13.55 (13.04–14.23), Co 0.03 (0.00–0.07), Ni 31.17 (30.76–31.77), Se 34.00 (33.53–34.76), total 100.39 (99.40–101.77). This gives the empirical formula $(\text{Cu}_{0.68}\text{Hg}_{0.27}\text{Ag}_{0.03}\text{Ni}_{0.01})_{\Sigma 0.99}(\text{Bi}_{0.69}\text{Pb}_{0.31})_{\Sigma 1.00}\text{Se}_{2.01}$ based on 4 apfu. The strongest lines in the X-ray powder-diffraction pattern [$d \text{ \AA}$ ($P\%$; hkl)] are: 3.97 (90; 111), 3.100 (40; $\bar{1}21$), 2.986 (100; $\bar{2}11$), 2.808 (50; 112), and 2.620 (50; 022). The unit-cell parameters refined from powder-diffraction data are: $a = 6.8529(4)$, $b = 7.6388(5)$, $c = 7.2669(6) \text{ \AA}$, $\beta = 97.662(5)^\circ$, $V = 377.01 \text{ \AA}^3$. Single-crystal X-ray diffraction data collected on a crystal of size $0.035 \times 0.040 \times 0.055 \text{ mm}$ refined to $R_1 = 0.0314$ for 713 unique $I \geq 4\sigma(I)$ reflections shows hansblockite is monoclinic, space group $P2_1/c$, $a = 6.853(1)$, $b = 7.635(1)$, $c = 7.264(1) \text{ \AA}$, $\beta = 97.68(1)^\circ$, $V =$

376.66 \AA^3 , and $Z = 4$. The new mineral is the monoclinic polymorph of grundmannite, CuBiSe_2 . Each (Bi,Pb) atom is coordinated to seven Se atoms to form monocapped trigonal prisms that share edges and caps to form double layers stacking perpendicular to the a axis. These double layers are separated by layers of (Cu,Hg) atoms tetrahedrally coordinated to Se. Hansblockite is named in honor of Hans Block (1881–1953) in recognition of his contribution to fostering Bolivian ore mining. The holotype specimen was deposited in the Natural History Museum, London, England. Cotype material is deposited within the Mineralogical State Collection Munich (Mineralogische Staatssammlung München, Museum “Reich der Kristalle”), Germany. **O.C.G.**

JASZCZAKITE*

L. Bindi and W.H. Paar (2017) Jaszczakite, $[(\text{Bi,Pb})_3\text{S}_3][\text{AuS}_2]$, a new mineral species from Nagybörzsöny, Hungary. *European Journal of Mineralogy*, 29(4), 673–677.

Jaszczakite (IMA 2016-077) with formula $[(\text{Bi,Pb})_3\text{S}_3][\text{AuS}_2]$, is a new mineral species discovered in a single ore specimen which contained earlier described jonassonite, $\text{Au}(\text{Bi,Pb})_5\text{S}_3$ from the abandoned Nagybörzsöny Au deposit at Alsó-Rózsa, northern Hungary. The deposit is bound to a breccia pipe hosted within Miocene calc-alkaline rocks. Jaszczakite is assumed to be formed more or less contemporaneously with jonassonite with which it is spatially related. Jaszczakite is intergrown with arsenopyrite, cosalite, and bismuth in quartz matrix. Other associated minerals in the only polish section are pyrite, marcasite, sphalerite, chalcopyrite, gold, bismuth, bismuthinite, and ikonolite. The mineral forms subhedral to anhedral grains up to $250 \mu\text{m}$. It is tin-white, metallic, with a black streak. Jaszczakite is brittle with an irregular fracture. Neither cleavage nor parting were observed. The micro-indentation hardness $\text{VHN}_5 = 122$ (115–132) kg/mm^2 , is similar to that of jonassonite (134.5 kg/mm^2) and corresponds to 2½–3 of Mohs scale. The density was not determined due to the paucity of available material and the penetrative intergrowth with other phases; $D_{\text{calc}} = 7.237 \text{ g/cm}^3$. In plane-polarized light jaszczakite is weakly bireflectant and pleochroic from light gray to a slightly bluish gray. Internal reflections are absent. The mineral is distinctly anisotropic with rotation tints very similar to those of jonassonite (shades of green and purple). The reflectance COM values in air [R_{min} , R_{max} % (nm)] are: 49.4, 50.9 (471.1); 47.1, 48.8 (548.3); 46.5, 47.7 (586.6); 48.8, 49.5 (652.3). The average of five electron-microprobe WDS analyses [wt% (range)] is Au 19.90 (19.14–20.55), Ag 0.22 (0.08–0.31), Bi 46.29 (45.90–46.98), Pb 16.50 (16.12–17.23), Cd 0.11 (0.04–0.16), Sb 0.12 (0.06–0.18), As 0.08 (0.04–0.15), S 16.17 (14.44–17.01), Se 0.16 (0.11–0.23), total 99.55 wt%. The empirical formula based on 9 atoms pfu is $\text{Au}_{1.00}\text{Ag}_{0.02}\text{Bi}_{2.18}\text{Pb}_{0.78}\text{Cd}_{0.01}\text{Sb}_{0.01}\text{As}_{0.01}\text{S}_{4.97}\text{Se}_{0.02}$ or The strongest lines in X-ray powder-diffraction lines [$d \text{ \AA}$ ($P\%$; hkl)] are: 7.466 (100; 011), 6.2760 (90; 020), 5.2003 (24; 021), 3.0963 (68; 003), 2.7768 (26; 023). The single crystal X-ray data show jaszczakite is orthorhombic, space group $Pmnm$, $a = 3.858(1)$, $b = 12.552(3)$, $c = 9.289(2) \text{ \AA}$, $V = 449.83 \text{ \AA}^3$, $Z = 2$. The crystal structure refined to $R_1 = 0.0285$ for 546 $F_o > 4\sigma(F_o)$ reflections. It consists of (Bi,Pb) $_3\text{S}_3$ layer with two crystallographically different cation positions Me1 and Me2 in tetragonal pyramids coordination. The cations are shifted out of the square towards the $[\text{AuS}_2]$ layers. Considering the structure refinement the empirical formula can be written as $[(\text{Bi}_{1.18}\text{Pb}_{0.78}\text{Ag}_{0.02}\text{Cd}_{0.01}\text{Sb}_{0.01}\text{As}_{0.01})_{\Sigma 3.01}\text{S}_3][\text{AuS}_2]$ or simplified to $[(\text{Bi,Pb})_3\text{S}_3][\text{AuS}_2]$. Jaszczakite is the S–Bi-analog of buckhornite $[\text{Pb}_2\text{BiS}_3][\text{AuTe}_2]$. The mineral is named in honor of John A. Jaszczak (b.1961), Professor of Physics at the Michigan Technological University, and Adjunct Curator at the A.E. Seaman Mineral Museum, well known for his significant contributions on the complexities of natural graphite. Holotype material is deposited in the Museo di Storia Naturale, Università degli Studi di Firenze, Firenze, Italy. **D.B.**

JUANSILVAITE*

A.R. Kampf, B.P. Nash, M. Dini, and A.A. Molina Donoso (2017) Juansilvaite, $\text{Na}_5\text{Al}_3[\text{AsO}_3(\text{OH})_4][\text{AsO}_2(\text{OH})_2]_2(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$, a new arsenate-sulfate from the Torrecillas mine, Iquique Province, Chile. Mineralogical Magazine, 81(3), 619–628.

Juansilvaite (IMA 2015-080), ideally $\text{Na}_5\text{Al}_3[\text{AsO}_3(\text{OH})_4][\text{AsO}_2(\text{OH})_2]_2(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$, is a new mineral found at the Torrecillas mine, Iquique Province, Chile. The Torrecillas deposit consists of two main veins rich in secondary arsenic and copper minerals that intersect metamorphosed marine shales and lavas. The new mineral occurs as a secondary alteration phase in association with anhydrite, canutite, halite, sulfur, and a mahnerite-like phase. The secondary assemblages at the Torrecillas deposit have formed from the oxidation of native arsenic and other As-bearing primary phases, followed by later alteration by saline fluids derived from evaporating meteoric water under hyperarid conditions. Juansilvaite occurs as blades up to ~0.5 mm long grouped in tightly intergrown radial aggregates, or as opaque rounded aggregates. Blades are flattened on {001}, elongated on [100] and exhibit the forms {001}, {111}, and {201}. Juansilvaite is bright pink, transparent with a white streak and vitreous luster. It is brittle with irregular fracture and very good cleavage on {001}. No twinning was observed. The mineral does not fluoresce under UV light. Mohs hardness is ~2½. $D_{\text{meas}} = 3.01(2)$ and $D_{\text{calc}} = 3.005 \text{ g/cm}^3$. Juansilvaite is optically biaxial (+), $\alpha = 1.575$, $\beta = 1.597$, $\gamma = 1.623$, $2V = 86(1)^\circ$ (white light); $X = \mathbf{b}$; $Z \wedge c = 27^\circ$ in the obtuse angle β . Dispersion of an optical axis is weak, $r < v$. The mineral is pleochroic in shades of pale pink; $X > Y \approx Z$. It is slowly soluble in dilute HCl at room temperature. The average of 10 electron probe WDS analyses on 5 crystals is [wt% (range)]: Na₂O 11.35 (10.85–12.20), CuO 0.24 (0.13–0.40), Al₂O₃ 8.61 (7.39–10.15), Mn₂O₃ 1.24 (0.56–2.34), Fe₂O₃ 2.97 (0.16–5.89), As₂O₅ 50.34 (48.47–54.74), SO₃ 10.82 (8.70–12.28), H₂O (calculated on the basis of Al + Fe + Mn = 3 apfu, charge balance and O = 36 apfu) 11.57, total 97.14. This gives the empirical formula $\text{Na}_{4.95}\text{Al}_{2.28}\text{Fe}_{0.50}\text{Mn}_{0.21}\text{Cu}_{0.04}\text{As}_{5.92}\text{S}_{1.85}\text{O}_{36}\text{H}_{17.37}$ based on O = 36 apfu. The strongest lines in the X-ray powder-diffraction pattern [$d \text{ \AA}$ (%; hkl)] are: 9.25 (100; 002), 7.20 (34; $\bar{1}11$), 4.545 (34; 400), 3.988 (39; 114), 3.363 (42; 314), 3.145 (66; 512,420), 2.960 (68; 422,422), 2.804 (33; 131,423). The unit-cell parameters refined from powder-diffraction data are: $a = 18.174(5)$, $b = 8.635(5)$, $c = 18.485(5) \text{ \AA}$, $\beta = 90.433(7)^\circ$, and $V = 2901 \text{ \AA}^3$. Single-crystal X-ray diffraction data collected on a crystal of size $80 \times 60 \times 10 \text{ \mu m}$ refined to $R_1 = 0.0382$ for 2040 unique $I \geq 4\sigma(I)$ reflections shows juansilvaite is monoclinic, $C2/c$, $a = 18.1775(13)$, $b = 8.6285(5)$, $c = 18.5138(13) \text{ \AA}$, $\beta = 90.389(6)^\circ$, $V = 2903.7 \text{ \AA}^3$, $Z = 4$. The crystal structure consists of layers of alternating corner-linked Al–O octahedra and acid-arsenate tetrahedra with Na occurring both peripheral to the layers and within cavities in the layers. SO₄ and H₂O also occurs in the interlayer region. Juansilvaite is named in honor of Juan Silva Aguirre (1939–2012), a prominent Chilean mining engineer and successful mining entrepreneur. Four cotype specimens are deposited in the collections of the Natural History Museum of Los Angeles County, California, U.S.A. **O.C.G.**

KRAVTSOVITE*

A. Vymazalová, F. Laufek, S.F. Sluzhenikin, C.J. Stanley, V.V. Kozlov, D.A. Chareev, and M.L. Lukashova (2017) Kravtsovite, PdAg₂S, a new mineral from the Noril'sk–Talnakh deposit, Krasnoyarskiy kray, Russia. European Journal of Mineralogy, 29(4), 597–602.

Kravtsovite (IMA 2016-092), ideally PdAg₂S, is a new mineral discovered at the Komsomolsky mine of the Talnakh deposit, Noril'sk district, Russia. It was found in vein-disseminated pyrite–chalcopyrite–galena ores, probably formed during the hydrothermal stage of ore formation. The host rock for the disseminated ore minerals is skarn, replacing

calcite matrix rock located beneath a basaltic sill. The mineral was also found in millerite–pyrite–chalcopyrite ore in the same mine. Kravtsovite forms equant inclusions (a few micrometers to 40–50 μm) in silicates (diopside, grossular, chlorite-group minerals) and in pyrite, commonly intergrown with vysotskite and Au–Ag alloy, chalcopyrite, rarely with galena. It is also found in aggregates (100–200 μm) intergrown with other platinum-group minerals such as telargpalite, cooperite, braggite, vysotskite, soppcheite, stibiopalladinite, sobolevskite, moncheite, kotulskite, malyshevite, and insizwaite. Kravtsovite is opaque with a metallic luster and gray streak (macro color is not mentioned). Its synthetic analog is brittle. $D_{\text{calc}} = 8.73 \text{ g/cm}^3$. In plane-polarized reflected light the mineral is similar to galena. It displays strong pleochroism in shades of slightly yellowish white to a bluish gray and strong anisotropy with rotation tints of salmon-pink, orange, pale blue, and dark blue–black. No internal reflections were observed. Reflectance values were measured between 400 and 700 nm in 20 nm intervals. The values for COM wavelengths [R_{min} , R_{max} % (nm)] in air are: 32.2, 38.3 (470); 31.6, 39.4 (546); 30.2, 39.8 (589); 28.8, 41.1 (650). The average of 18 electron probe WDS analyses is [wt% (range)]: Pd 30.53 (29.41–32.11), Ag 60.11 (59.15–62.00), S 8.47 (7.98–8.79), Se 0.74 (0.33–1.12), total 99.85. This gives the empirical formula $\text{Pd}_{1.03}\text{Ag}_{1.99}(\text{S}_{0.95}\text{Se}_{0.03})_{20.98}$ based on 4 apfu. The strongest lines in the X-ray powder-diffraction pattern [$d \text{ \AA}$ (%; hkl)] are: 2.632 (51; 021), 2.458 (65; 112), 2.4263 (71; 310), 2.3305 (60; 202), 2.2352 (100; 311), 2.1973 (48; 221), 2.0619 (42; 022), 1.9172 (30; 130), 1.3888 (31; 240,332), 1.3586 (28; 512). Kravtsovite is orthorhombic, space group $Cmcm$, with $a = 7.9835(1)$, $b = 5.9265(1)$, $c = 5.7451(1) \text{ \AA}$, $V = 271.82 \text{ \AA}^3$, and $Z = 4$. The small size and fine intergrowths with other minerals prevented the crystal extraction for single crystal study. The crystal structure was refined from the powder X-ray-diffraction data of the synthetic analogue. The structure of Na₂AuBi was used as the initial model in the subsequent Rietveld refinement of PdAg₂S. The structure consists of [Pd–S–Pd–S]_z zigzag chains running along the c-axis, with no Pd–S bonds between neighbouring chains. Each Ag atom connects three [Pd–S–Pd–S]_z chains via Ag–S and Ag–Pd bonds. Kravtsovite is named in honor of Viktor Fomich Kravtsov (1932–2014), one of the discoverers of the Talnakh and Oktyabrsk deposits in the Noril'sk district of Russia. Holotype material was deposited at the Department of Earth Sciences of the Natural History Museum, London, U.K. **O.C.G.**

MAGNESIOCANUTITE*

A.R. Kampf, B.P. Nash, D. Maurizio and A.A. Molina Donoso (2017) Magnesiocanutite, $\text{NaMnMg}_2[\text{AsO}_4]_2[\text{AsO}_2(\text{OH})_2]$, a new protonated alluaudite-group mineral from the Torrecillas mine, Iquique Province, Chile. Mineralogical Magazine, 81(6), 1523–1531.

Magnesiocanutite (IMA 2016-057), ideally $\text{NaMnMg}_2[\text{AsO}_4]_2[\text{AsO}_2(\text{OH})_2]$, monoclinic, is a new member of the alluaudite group discovered at the Torrecillas arsenic mine, Salar Grande, Iquique Province, Tarapacá Region, Chile (~20°58'13"S 70°8'17"W), where it occurs as a secondary phase in association with anhydrite, canutite, halite, lavendulan, and magnesiokoritnigite. The Torrecillas deposit, consists of two main veins rich in secondary arsenic and copper minerals that intersect metamorphosed marine shales and lavas. These veins are related to the andesites and porphyritic lavas of the Jurassic La Negra Formation. Over the last several years, investigations of the mineralogy of that mine have revealed a remarkable assemblage of rare secondary chlorides, arsenates, and arsenites, many of which are new mineral species. Magnesiocanutite occurs as pale brownish-pink to rose-pink, lozenge-shaped tablets up to ~0.5 mm that are often grouped in tightly intergrown aggregates. Tablets are flattened on {102} and slightly elongated on [201]. The crystal forms are {110} and {102}. Crystals are transparent, with vitreous luster and white to very pale pink streak. The cleavage is perfect on {010} and {101}. The mineral

is brittle with a splintery fracture and Mohs hardness $\sim 2\frac{1}{2}$. Efforts to measure the density failed because of the difficulty in identifying the most Mg-rich crystal aggregates and observing them in the Clerici solution; $D_{\text{calc}} = 3.957 \text{ g/cm}^3$. Magnesioacanuite is optically biaxial (+), $\alpha = 1.689(2)$, $\beta = 1.700(2)$, $\gamma = 1.730(2)$ (white light); $2V = 64(4)^\circ$; $Z = \mathbf{b}$; $X \wedge \mathbf{a} = 15^\circ$ in obtuse angle β . Dispersion of an optical axes is weak, $r < v$. The mineral is slowly soluble in dilute HCl at room temperature. The average of electron probe WDS analyses (nine points on four crystals) is [wt% (range)]: Na₂O 5.44 (5.21–5.59), CaO 0.26 (0.11–0.31), MgO 8.84 (8.17–10.35), MnO 18.45 (16.28–19.60), CoO 1.47 (1.13–1.78), CuO 2.13 (1.20–2.75), As₂O₅ 59.51 (58.85–60.75), H₂O (calculated on the basis of 3 As, charge balance, and 12 O apfu) 2.86, total 98.96. The empirical formula based on 12 O pfu is (Na_{1.02}Ca_{0.03}Mn_{1.51}Mg_{1.27}Cu_{0.16}Co_{0.11})_{Σ4.10}As₃O₁₂H_{1.84}. Magnesioacanuite exhibited visible damage under the electron beam. Sodium peak is decreasing in intensity during the analyses, whereas As sustained an increase; both were accounted by extrapolation. The strongest lines in the powder X-ray diffraction pattern are [$d \text{ \AA}$ ($I\%$; hkl)]: 6.25 (42; 020), 3.566 (43; 310, $\bar{1}31$), 3.262 (96; $\bar{1}12$), 3.120 (59; 002, 131, 040, 221), 2.787 (93; 400, 022, 041, 330), 2.718 (100; 421, 240, 112, 402), 2.641 (42; $\bar{1}32$), 1.503 (43; multiple). Unit-cell parameters refined from the powder data are $a = 12.183(5)$, $b = 12.506(6)$, $c = 6.802(5) \text{ \AA}$, $\beta = 112.803(13)^\circ$, $V = 955.4 \text{ \AA}^3$. The single-crystal X-ray diffraction study confirmed the mineral is monoclinic, $C2/c$, $a = 12.2514(8)$, $b = 12.4980(9)$, $c = 6.8345(5) \text{ \AA}$, $\beta = 113.167(8)^\circ$, $V = 962.10 \text{ \AA}^3$, and $Z = 4$. The crystal structure was refined to $R_1 = 2.59\%$ for $789 F_o > 4\sigma F_o$ reflections. Magnesioacanuite has a protonated alluaudite-type structure and is the Mg analog of canuite with Mg dominant over Mn in the M2 site which is reflected in its name. The general formula of these phases is $AM_1M_2[71O_4][T2O_3(OH)]_2$ { $A = \text{Na, Ca}$; $M = \text{Mn, Mg, Fe, Zn, Cu, Ca}$; $T = \text{P, As}$ }, where the $M1$ and $M2$ octahedra link by edge sharing to form staggered chains, $T1$ and $T2$ tetrahedra crosslink the chains, and A cations occupy large channel sites. The structurally based empirical formula of magnesioacanuite is $\text{Na}(\text{Mn}_{0.78}\text{Mg}_{0.22})_{\Sigma 1.00}(\text{Mg}_{1.04}\text{Mn}_{0.70}\text{Cu}_{0.15}\text{Co}_{0.11})_{\Sigma 2.00}[\text{AsO}_4]_2[\text{AsO}_2(\text{OH})_2]$. The name reflects the fact that the mineral is the Mg analogue of canuite. The holotype and one cotype specimen are deposited at the Natural History Museum of Los Angeles County, Los Angeles, California, U.S.A. **D.B.**

MANECKIITE*

A. Pieczka, F.C. Hawthorne, B. Gołębiewska, A. Włodek, and A. Grochowina (2017) Maneckiite, ideally $\text{NaCa}_2\text{Fe}_2^{3+}(\text{Fe}^{3+}\text{Mg})\text{Mn}_2(\text{PO}_4)_6(\text{H}_2\text{O})_2$, a new phosphate mineral of the wicksite supergroup from the Michałkowa pegmatite, Góry Sowie Block, southwestern Poland. *Mineralogical Magazine*, 81(3), 723–736.

Maneckite (IMA 2015-056), ideally $\text{NaCa}_2\text{Fe}_2^{3+}(\text{Fe}^{3+}\text{Mg})\text{Mn}_2(\text{PO}_4)_6(\text{H}_2\text{O})_2$, is a new mineral discovered in Michałkowa, Góry Sowie Block, SW Poland. Maneckiite occurs in an anatectic lithium-cesium-tantalum pegmatite, coeval with the younger stage of Góry Sowie Block metamorphism at 380–370 Ma. It appears to be a product of Na- and Ca-metasomatism induced by a HT fluid in the presence of Al^{3+} from a neighbouring aluminosilicate melt. Maneckiite found in association with fluorapatite, wolfeite, Ca-rich graffonite and alluaudite-group minerals. It forms subhedral and anhedral crystals (sometimes zoned) $\sim 150 \mu\text{m} \times 150 \mu\text{m}$ in size in the outer zone of phosphate nodules. Crystals are dark brown, with colorless streak and a vitreous luster. The cleavage is good on {010}. The mineral is brittle, with a splintery fracture and no parting. Mohs hardness is ~ 5 . The density was not measured due to small grain size and intergrowths; $D_{\text{calc}} = 3.531 \text{ g/cm}^3$. Maneckiite is optically biaxial (+), $\alpha = 1.698(2)$, $\beta = 1.706(2)$, $\gamma = 1.727(2)$, $2V = 66(1.5)^\circ$ (589.9 nm); $2V_{\text{calc}} = 64^\circ$; $X//\mathbf{a}$, $Y//\mathbf{b}$, $Z//\mathbf{c}$. It is pleochroic $X = \text{dark green} > Y = \text{dark blue/green} > Z = \text{light brown/tan}$. No fluorescence in UV light was observed. The average of 14 electron probe WDS analyses of the holotype crystal is

[wt% (range)]: P₂O₅ 42.45 (40.93–43.81), Fe₂O₃(calc) 8.65 (7.82–9.87), FeO(calc) 15.19 (12.70–17.48), MnO 11.64 (8.82–14.57), CaO 11.07 (10.78–11.28), MgO 4.56 (1.59–6.78), SrO 0.15 (0–0.68), Na₂O 2.81 (2.42–3.07), H₂O(calc) 3.58 (3.51–3.70), total 100.02 (98.81–101.54). This gives the empirical formula $(\text{Na}_{0.91}\square_{0.09})_{\Sigma 1.00}(\text{Ca}_{1.98}\text{Sr}_{0.01})_{\Sigma 2.00}{}^{M(1)}(\text{Fe}_{1.77}^{3+}\text{Mg}_{0.23})_{\Sigma 2.00}{}^{M(2)}(\text{Fe}_{1.09}^{3+}\text{Mg}_{0.91})_{\Sigma 2.00}{}^{M(3)}(\text{Mn}_{1.65}\text{Fe}_{0.35})_{\Sigma 2.00}(\text{PO}_4)_6(\text{H}_2\text{O})_2$ based on $\text{Fe}^{3+} + \text{Fe}^{2+} + \text{Mn} + \text{Ca} + \text{Mg} + \text{Sr} = 8$ apfu with ideal contents of P₂O₅, calculated by stoichiometry. The Fe₂O₃ and H₂O contents were obtained based on electroneutrality and the stoichiometry of the wicksite group compounds. The strongest lines in the calculated X-ray powder-diffraction pattern [$d_{\text{calc}} \text{ \AA}$ ($I\%$; hkl)]: 2.759 (100; 402), 2.916 (78; 004), 3.020 (68; 401), 2.844 (35; 014), 2.869 (31; 240), 2.825 (30; 042). Single-crystal X-ray diffraction data collected on a crystal of size $25 \times 40 \times 60 \mu\text{m}$ refined to $R_1 = 0.0179$ for 2612 unique $I \geq 4\sigma(I)$ reflections shows maneckiite is orthorhombic, space group $Pcab$, $a = 12.526(4) \text{ \AA}$, $b = 12.914(5) \text{ \AA}$, $c = 11.664(4) \text{ \AA}$, $V = 1886.8 \text{ \AA}^3$, $Z = 4$. Maneckiite is a member of the wicksite group. It is the $M^{(3)}$ Mn-analog of wicksite with Fe^{2+} completely ordered at the $M(1)$ site, $\text{Fe}^{3+} = \text{Mg}$ at the $M(2)$ site, and Mn^{2+} completely ordered at the $M(3)$ site. The name honors Andrzej Manecki, eminent Polish mineralogist and emeritus Professor at the Department of Mineralogy, Petrography, and Geochemistry in the Faculty of Geology, Geophysics and Environmental Protection, AGH University of Science and Technology in Cracow, Poland. Holotype and cotype specimens are deposited in the Mineralogical Museum of the University of Wrocław, Wrocław, Poland. **O.C.G.**

OMARINIITE*

L. Bindi, H. Putz, W.H. Paar, and C.J. Stanley (2017) Omariniite, $\text{Cu}_8\text{Fe}_2\text{ZnGe}_2\text{S}_{12}$, the germanium analogue of stannoidite, a new mineral species from Capillitas, Argentina. *Mineralogical Magazine*, 81(5), 1151–1159.

Omariniite (IMA 2016-050), ideally $\text{Cu}_8\text{Fe}_2\text{ZnGe}_2\text{S}_{12}$, was discovered in the Capillitas mining district, Farallón Negro Volcanic Complex, the Province of Catamarca, Argentina. The Capillitas diatreme represents one of the volcanic centers within the granitic basement block of the Sierra de Capillitas composed of ignimbrite, rhyolite porphyry, dacite porphyry, and tuff. The epithermal veins of Capillitas deposit are hosted in rhyolite, ignimbrite and granite and show different types of host-rock alteration and different sulfidation stages of mineralization. Omariniite is relatively abundant in high-grade bornite-chalcocite copper ores restricted to the central part of the deposit, where it is closely associated with two other Ge minerals putzite and catamarcaite, and rarely with zincobriartite. In the putzite holotype specimen omariniite frequently occurs as either a rim or seam at the contact between putzite and chalcocite, rarely exceeding a width of 60 μm but attaining a length of several hundreds of micrometers; or as an envelope around the anhedral to subhedral inclusions within putzite and chalcocite, where it is sometimes associated with zincobriartite. Other associated minerals observed in the omariniite-bearing copper ores are wittichenite, tenantite, thalcosite, and rare grains of mawsonite. The new mineral also occurs in the holotype specimen of catamarcaite as an envelope around catamarcaite inclusions within chalcocite/digenite/covellite/sphalerite in association with luzonite. Omariniite is orange-brown and opaque, and has a reddish-brown streak and metallic luster. It is brittle and exhibits an irregular to sub-conchoidal fracture. Cleavage and parting were not observed. The micro-indentation hardness $\text{VHN}_{100} = 202$ (190–215) kg/mm^2 corresponding to $3\frac{1}{2}$ of the Mohs scale. The density was not measured due to the paucity of material and due to penetrative intergrowths with other phases; $D_{\text{calc}} = 4.319 \text{ g/cm}^3$. In plane-polarized light omariniite is orange-brown with a weak pleochroism and birefractance. In crossed polars, the new mineral is distinctly anisotropic, with rotation tints from brownish-orange to greenish-brown. The reflectance values

measured in air between 400 and 700 nm at intervals of 0.8135 nm [R_{\max} , R_{\min} %, (nm)] are: 22.0, 21.9 (400); 21.5, 20.9 (420); 21.0, 20.2 (440); 21.0, 19.7 (460); 21.0, 19.5 (480); 21.1, 19.4 (500); 21.4, 19.75 (520); 21.8, 20.4 (540); 22.2, 21.2 (560); 22.8, 22.1 (580); 23.5, 23.2 (600); 24.2, 24.2 (620); 25.3, 25.0 (640); 26.2, 25.7 (660); 27.2, 26.6 (680); 28.2, 27.4 (700). The averaged 45 point WDS electron probe analyses is [wt% (range)]: Cu 42.18 (41.46–43.13), Fe 9.37 (8.94–10.20), Zn 5.17 (4.30–5.96), In 0.20 (0.10–0.30), Ge 11.62 (11.04–12.02), S 31.80 (31.41–32.30), total 100.34. The empirical formula is $\text{Cu}_{8.04}(\text{Fe}_{2.05}\text{In}_{0.02})_{22.05}\text{Zn}_{0.96}\text{Ge}_{1.94}\text{S}_{12.01}$ based on 25 (Me+S) apfu. The strongest lines of the powder X-ray diffraction pattern calculated on the basis of the structural model are [d_{calc} Å ($I_{\text{rel}}\%$; hkl): 3.1063 (100; 213); 1.9055 (24; 420); 1.9010 (23; 026); 1.9001 (23; 406); 1.6248 (12; 233); 1.6237 (12; 613); 1.6181 (11; 219). Omariniite is orthorhombic, $I222$, $a = 10.774(1)$, $b = 5.3921(5)$, $c = 16.085(2)$ Å, $V = 934.5$ Å³, and $Z = 2$. The crystal structure of omariniite is a sphalerite derivative. It is also can be considered to be derived from the stannite structure by substituting Cu atoms for a set of Ge atoms and adding excess Cu atoms in a set of tetrahedral vacancies. The structure of omariniite was refined to $R = 2.3\%$ starting with atomic coordinates of its tin analog stannoidite $\text{Cu}_8(\text{Fe,Zn})_2\text{Sn}_2\text{S}_{12}$. The name honors Ricardo Héctor Omarini (1946–2015), Professor at the University of Salta, for his outstanding contributions to the geology of Argentina. Holotype material is housed in the National Mineral Collection of Canada, Geological Survey of Canada, Ottawa, Ontario. The cotype specimens are deposited in the University of Firenze, Italy, in the Natural History Museum of London, U.K., and in the private collections of two of the authors (Hubert Putz and Werner H. Paar). **Yu.U.**

PŘÍBRAMITE*

P. Škácha, J. Sejkora, and J. Plášil (2017) Příbramite, CuSbSe_2 , the Se-analogue of chalcostibite, a new mineral from Příbram, Czech Republic. *European Journal of Mineralogy*, 29(4), 653–661.

Příbramite (IMA 2015-127), ideally CuSbSe_2 , is a new mineral found on the dump of shaft No. 16, one of the mines in the Příbram uranium and base-metal district, central Bohemia, Czech Republic. Příbramite was found among a very rich selenide assemblage associated with antimonoselite, permanganite, dzharkenite, ferroselite, hakite, tetrahedrite, chaméanite, giraudite, a new Hg-Sb-Cu selenide, a new Sb-Cu selenide, and uraninite. The new mineral occurs as subhedral blade-shaped crystals up to 60×12 μm (in the thin section), growing together in aggregates up to 150 μm across in the calcite gangue. Crystals form intergrowths and replace older permanganite. Příbramite was also found as anhedral grains up to 15 μm in size growing with a Sb-Cu selenide. Crystals are lead gray, opaque with metallic luster. They are brittle, and show no cleavage or fracture. $D_{\text{calc}} = 5.884$ g/cm³. Mohs hardness is assumed to be 3–4. In reflected light, příbramite is gray with a yellowish hue and medium birefractance and weak pleochroism in gray tints. It is strongly anisotropic with gray to brownish rotation tints. Internal reflections were not observed. Reflectance values were measured between 400 and 700 nm in 20 nm intervals. The values for COM wavelengths [R_{\min} , R_{\max} % (nm)] in air are: 39.8, 44.8 (470); 40.4, 46.2 (546); 40.4, 46.5 (589); 38.9, 44.8 (650). The average of 53 electron probe WDS analyses is [wt% (range)]: Ag 0.00 (0–0.07), Fe 0.07 (0–0.54), Pb 0.02 (0–0.23), Tl 0.02 (0–0.60), Hg 0.09 (0–0.45), Cu 18.75 (16.11–20.38), Sb 36.75 (33.62–39.49), As 0.28 (0–1.34), Se 42.21 (37.80–44.39), S 1.45 (0.64–3.49), total 99.86. This gives the empirical formula $\text{Cu}_{1.00}(\text{Sb}_{1.02}\text{As}_{0.01})_{1.03}(\text{Se}_{1.81}\text{S}_{0.13})_{1.96}$ based on 4 apfu. The strongest lines in the

calculated X-ray powder-diffraction pattern [d_{calc} Å ($I_{\text{rel}}\%$; hkl)] are: 3.152 (40; 200), 3.113 (100; 013), 3.085 (40; 201), 3.395 (63; 015), 1.9900 (38; 020), 1.8442 (42; 311), and 1.8329 (33; 304). Single-crystal X-ray diffraction data collected on a crystal of size $0.029 \times 0.022 \times 0.013$ mm refined to $R_1 = 0.0480$ shows that příbramite is orthorhombic, $Pnma$, $a = 6.3042(15)$, $b = 3.980(1)$, $c = 14.989(4)$ Å, with $V = 376.09(2)$ Å³ and $Z = 4$. Příbramite is isostructural with chalcostibite and emplectite. The structure consists of square Sb pyramids linked to form chains of SbSe_2 along **b** and CuSe_4 tetrahedra forming chains of CuSe , parallel to **b**. The two types of infinite chains are then linked to form sheets, stacked perpendicular to **c**. Příbramite is named after its type locality. The cotype material is deposited in the Department of Mineralogy and Petrology of the National Museum, Prague, Czech Republic, and in the Mining Museum Příbram, Czech Republic. **O.C.G.**

RICHARDSOLLYITE*

N. Meisser, P. Roth, F. Nestola, C. Biagioni, L. Bindi, and M. Robyr (2017) Richardsollyite, TlPbAsS_3 , a new sulfosalt from the Lengenbach quarry, Binn Valley, Switzerland. *European Journal of Mineralogy*, 29(4), 679–688.

Richardsollyite (IMA 2016-043), ideally TlPbAsS_3 , is a new mineral found at the Lengenbach quarry, Imfeld, Binn Valley, Canton Valais, Switzerland. The new mineral was collected in cavities of the Triassic metadolostone exposed in the Lengenbach quarry. The Lengenbach deposit formed from the remobilization of a pre-existing carbonate-hosted Pb–Zn–Ag–Cu–Cd–Tl–As ore deposit and subsequent crystallization from sulfide melt as well as hydrothermal solutions. Richardsollyite is believed to have resulted from the fractional crystallization of the sulfide melt. The new mineral is closely associated with hutchinsonite and barite. Richardsollyite forms gray-black euhedral crystals up to 750 μm across. Crystals have black streak and metallic luster, are brittle with uneven fracture and no apparent cleavage. The micro-indentation hardness $\text{VHN}_{25} = 188$ (170–203) kg/mm² corresponding to a Mohs hardness of $\sim 3\text{--}3\frac{1}{2}$. Density was not measured due to paucity of material; $D_{\text{calc}} = 6.392$ g/cm³. Richardsollyite is gray in reflected light with bright-red internal reflections. Anisotropy is distinct, with grayish-white to bluish rotation tints. Reflectance values were measured between 400 and 700 nm in 20 nm intervals. The values for COM wavelengths [R_{\min} , R_{\max} % (nm)] in air are: 27.9, 29.8 (470); 27.8, 31.0 (546); 27.3, 30.8 (589); 27.0, 30.5 (650). The average of 9 electron probe WDS analyses is [wt% (range)]: Tl 34.72 (33.92–35.32), Pb 35.45 (35.07–35.69), As 12.80 (12.64–3.12), Sb 0.04 (0.02–0.07), S 16.22 (16.02–16.44), total 99.24. This gives the empirical formula $\text{Tl}_{1.00}\text{Pb}_{1.01}(\text{As}_{1.01}\text{Sb}_{<0.01})_{21.01}\text{S}_{2.98}$ based on 6 apfu. The strongest lines in the X-ray powder-diffraction pattern [d Å ($I_{\text{rel}}\%$; hkl)] are: 4.23 (80; $\bar{1}02$), 3.875 (70; $\bar{2}11$), 3.762 (100; $\bar{2}10, 120$), 3.278 (70; 102), 2.931 (70; 022), 2.714 (70; $\bar{1}13$), 2.622 (80; $\bar{3}12$). Single-crystal X-ray diffraction data collected on a crystal of size $0.20 \times 0.10 \times 0.06$ mm refined to $R_1 = 0.0242$ for 1590 unique $I \geq 4\sigma(I)$ reflections shows richardsollyite is monoclinic, space group $P2_1/c$, with $a = 8.8925(2)$, $b = 8.4154(2)$, $c = 8.5754(2)$ Å, $\beta = 108.665(3)^\circ$, $V = 607.98$ Å³, $Z = 4$. The new mineral is isostructural with synthetic ABCX_3 compounds. The structure consists of (100) $[\text{Pb}(\text{AsS}_3)]^-$ layers sandwiching Tl^+ cations. Richardsollyite is named in honor of Richard Harrison Solly (1851–1925), a British autodidact who described eight new mineral species from Lengenbach. The holotype specimen is deposited in the Musée cantonal de géologie, University of Lausanne, Switzerland. **O.C.G.**