

## NEW MINERAL NAMES\*

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### Clinobirnessite

A.I. Gorshkov, V.A. Drits, V.S. Putilina, E.V. Pokrovskaya, A.V. Sivtsov (1992) Natural and synthetic birnessites. *Litol. Polezn. Iskop.*, no. 6, 67–81 (in Russian; English transl. in *Lithology and Mineral Resources*, 27, 503–514).

The existence of natural monoclinic and hexagonal birnessite was described by Manceau, Gorshkov, and Drits in *Am. Mineral.*, 77, 1144–1157 (1992). Structural interpretation of electron diffraction patterns indicates that the cell for monoclinic birnessite has  $a = 8.54$ ,  $b = 15.39$ ,  $c = 7 \text{ \AA}$ ,  $\beta = 132.2^\circ$ . In addition, a structural modification occurs with  $a = 10.44$ ,  $b = 8.76$ ,  $c = \approx 14 \text{ \AA}$ ,  $\gamma = 110^\circ$ ; it is single-layered triclinic or double-layered monoclinic, has an orderly distribution of vacancies, and is referred to as clinobirnessite.

**Discussion.** To date, the only approved name, which includes all structural types, is birnessite. J.L.J.

### Hunchunite\*

Shangquan Wu, Yi Yang, Qun Song (1992) A new gold mineral—hunchunite (Au<sub>2</sub>Pb). *Acta Mineral. Sinica*, 12(4), 319–322 (in Chinese, English abs.).

Seven electron microprobe analyses gave Au 63.38–66.26, Ag 1.68–2.96, Pb 31.60–34.64, sum 99.54–99.98 wt%, close to Au<sub>2</sub>Pb. Occurs as anhedral granular aggregates, 170–500 × 3–30 μm, intergrown with gold, aniyuite, and lead in gold concentrates from Quaternary alluvial placers along the Hunchun River, eastern Jilin Province, China. Opaque, metallic luster,  $H_s = 128$ –149 kg/mm<sup>2</sup>,  $D_{\text{calc}} = 15.99 \text{ g/cm}^3$  for  $Z = 8$ . Silver gray color in reflected light, tarnishes to dull gray in 1½–2 d; isotropic; reflectance percentages in air (WC standard) are 40.9 (405 nm), 48.8 (436), 58.4 (480), 57.9 (526), 59.5 (546), 60.0 (589), 64.0 (644), and 60.0 (656). Cubic by analogy with synthetic Au<sub>2</sub>Pb (PDF 28–436), with which the X-ray powder pattern (Cu radiation) is in good agreement; space group *Fd3m*,  $a = 7.933 \text{ \AA}$ . Strongest lines of the pattern are 2.810(30,220), 2.391(100,311), 2.301(24,222),

1.526(23,511), and 1.196(26,622). The new name alludes to the type locality, along the Hunchun River. Type material is in the National Geological Museum (in Beijing?).

**Discussion.** The average of the seven microprobe analyses is Au 64.78, Ag 2.18, Pb 32.91, sum 99.87 wt%, corresponding to Au<sub>1.94</sub>Ag<sub>0.12</sub>Pb<sub>0.94</sub> for two formula atoms. J.L.J.

### Szenicsite\*

C.A. Francis, L.C. Pitman, D.E. Lange (1994) Szenicsite, a new mineral from Tierra Amarilla, Chile. *Mineral. Record*, 25(1), 76.

Electron microprobe analysis and TGA gave CuO 56.25, MoO<sub>3</sub> 34.00, H<sub>2</sub>O 8.99, sum 99.24 wt%, corresponding to Cu<sub>2.99</sub>(MoO<sub>4</sub>)(OH)<sub>4.11</sub>, ideally Cu<sub>3</sub>(MoO<sub>4</sub>)(OH)<sub>4</sub>. Occurs as fracture fillings and freestanding dark green bladed crystals to 3 × 1 × 0.1 cm; crystals are elongate [001], with dominant {100} and common {010}, typically in radial aggregates. Adamantine luster,  $H = 3.5$ –4,  $D_{\text{meas}} = 4.26$ ,  $D_{\text{calc}} = 4.30 \text{ g/cm}^3$  for  $Z = 4$ . Optically biaxial positive,  $\alpha = 1.886(2)$ ,  $\beta = 1.892(2)$ ,  $\gamma = 1.903(2)$ ,  $2V_{\text{meas}} = 74(3)$ ,  $2V_{\text{calc}} = 73^\circ$ , nonpleochroic,  $X = \mathbf{b}$ ,  $Y = \mathbf{a}$ ,  $Z = \mathbf{c}$ , strong dispersion  $r > v$ . Orthorhombic, space group *Pnmm*,  $a = 8.449(3)$ ,  $b = 12.527(6)$ ,  $c = 6.067(1) \text{ \AA}$ . Strongest lines of the powder pattern (diffractometer) are 5.057(48,120), 3.759(100,130), 2.773(57,310), 2.591(67,320), and 2.132(31,400).

The mineral was derived by the oxidation of bornite and molybdenite and is associated with powellite, chrysocolla, brochantite, hematite, and quartz from a mine near Tierra Amarilla, Atacama, Chile. The new name is for T. and M. Szenics, the finders of the mineral.

**Discussion.** Our general policy is not to write abstracts of abstracts, but an exception is made in this case because the description is relatively complete. The authors' institution is the Harvard Mineralogical Museum, presumably the repository for the type material. J.L.J.

### Tetrarooseveltite\*

J. Sejkora, T. Řídkošil (1994) Tetrarooseveltite, β-Bi(AsO<sub>4</sub>), a new mineral species from Moldava deposit, the Krušný Hory Mts., northwestern Bohemia, Czech Republic. *Neues Jahrb. Mineral. Mon.*, 179–184.

\* Before publication, minerals marked with an asterisk were approved by the Commission on New Minerals and Mineral Names, International Mineralogical Association.

The mineral consists of grains up to 50  $\mu\text{m}$  in diameter that form powdery aggregates up to 10 mm in diameter on fluorite and barite. White to yellowish color, earthy luster, nonluminescent, soluble in cold HCl,  $D_{\text{calc}} = 7.64 \text{ g/cm}^3$  for  $Z = 4$ . Optically uniaxial positive, mean  $n = 2.20(5)$ . Electron microprobe analysis (average of six) gave  $\text{Bi}_2\text{O}_3$  66.96,  $\text{As}_2\text{O}_5$  33.02,  $\text{P}_2\text{O}_5$  0.03, sum 100.01 wt%, corresponding to  $\text{Bi}(\text{AsO}_4)$ . The X-ray powder pattern is in good agreement with that of synthetic tetragonal  $\text{Bi}(\text{AsO}_4)$ , and by analogy  $a = 5.085(5)$ ,  $c = 11.69(2)$  Å, space group  $I4_1/a$ ; strongest lines of the pattern (13 lines given; diffractometer, Cu radiation) are 4.660(11,101), 3.066(100,112), 2.546(12,200), 1.933(55,204; overlaps fluorite), 1.797(11,220), 1.581(10,107), and 1.551(17,312).

The mineral occurs as an oxidation product associated with bayldonite, malachite, and mimetite in a fluorite + barite + quartz vein in the Moldava Bi-Ag-As-Co-Ni deposit near Teplice, Czech Republic. The name alludes to the tetragonal symmetry and polymorphism with rooseveltite (monoclinic). Type material is in the Národní Muzeum, Praha (Prague). **J.L.J.**

#### **Au(Te,Tl), Cu<sub>3</sub>(Bi,Tl)S<sub>4</sub>**

S.V. Nechaev, S.N. Bondarenko (1993) Thallium minerals in the Ukrainian Shield. *Mineral. Zhurnal*, 15(1), 75–79 (in Russian).

Electron microprobe analyses gave Au 56.54, 56.32, Te 22.72, 21.65, Tl 18.19, 19.83, sum 97.44, 97.80 wt%, corresponding to  $\text{Au}(\text{Te}_{0.64}\text{Tl}_{0.32})_{20.96}$ . Microprobe analysis of another mineral gave Tl 16.0, Cu 23.8, Fe 0.7, Bi 42.2, Ag 0.4, Pb 0.1, S 16.0, Te 0.1, Se 0.2, sum 99.5 wt%, corresponding to  $(\text{Cu}_{2.88}\text{Fe}_{0.1})_{22.98}(\text{Ni}_{1.55}\text{Tl}_{0.6})_{22.15}\text{S}_{3.84}$ , simplified as  $\text{Cu}_3(\text{Bi,Tl})_2\text{S}_4$ . The minerals occur with Bi and Sb sulfosalts and thalcosite in scheelite-bearing skarns of the Kamensk deposit in the Ukrainian Shield. **J.L.J.**

#### **(Pd,Pt)<sub>4</sub>Sb<sub>3</sub>, (Pd,Cu)<sub>3</sub>Sb, (Pd,Rh)<sub>2</sub>(Sb,As), (Rh,Ir)SbS, (Ni,Fe,Rh)S, (Rh,Pt)<sub>3</sub>(Fe,Ni)<sub>3</sub>S<sub>8</sub>**

T.L. Evstigneyeva, A.S. Kudryavtsev, N.S. Rudashevskiy (1992) Minerals of the platinum-group elements from Yubdo (Ethiopia): New data. *Mineral. Zhurnal*, 14(1), 29–41 (in Russian).

The unnamed minerals were found in the heavy concentrates from placers of the Yubdo platinum deposit, middle course of the Birbir River, eastern Welega Province, Ethiopia. The predominant minerals in the heavy concentrates are isoferroplatinum, tetraferroplatinum, and nickelian tulameenite. Closely associated minerals include Os-Ir-Ru-Pt-Rh alloys (e.g., Os, Ir), sperrylite, irarsite, hollingworthite, erlichmanite, laurite, and stibio-palladinite. Gold, cubanite, bornite, chalcopyrite, galena, chromite, and magnetite are also found in the heavy fraction. The material rich in Pt, Ir, and Os is inferred to have had a magmatic origin and subsequently altered under hydrothermal and near-surface (during laterization)

conditions. The minerals reported here are inferred to have formed during the concluding part the hydrothermal metasomatic stage.

#### **(Pd,Pt)<sub>4</sub>Sb<sub>3</sub>**

Electron microprobe analysis gave Pt 13.40, Pd 58.60, Ir 0.15, Rh 0.20, Cu 0.75, Fe 0.05, Sb 58.60, As 0.29, sum 98.74 wt%, corresponding to  $(\text{Pd}_{3.43}\text{Pt}_{0.42}\text{Cu}_{0.07})_{23.92}\text{Sb}_{3.01}$ , that is, a possible Pd analogue of genkinite. The mineral occurs as inclusions up to 10  $\mu\text{m}$  in a highly fractured grain of isoferroplatinum.

#### **(Pd,Cu)<sub>3</sub>Sb**

Electron microprobe analysis gave Pt 0.91, Pd 71.30, Ir 0.05, Rh 0.07, Cu 1.30, Fe 0.03, Sb 28.00, Bi 0.27, sum 101.93 wt%, corresponding to  $(\text{Pd}_{2.88}\text{Cu}_{0.08})_{22.96}\text{Sb}_{1.0}$ . The mineral occurs as inclusions up to 10  $\mu\text{m}$  in an unfractured isoferroplatinum matrix in which stumpflite was also found.

#### **(Pd,Rh)<sub>2</sub>(Sb,As)**

Electron microprobe analysis gave Pt 0.90, Pd 36.20, Ir 0.03, Rh 30.50, Ru 0, Cu 0.04, Fe 0.07, As 11.90, Sb 19.70, Bi 0.36, sum 99.70 wt%, corresponding to  $(\text{Pd}_{1.06}\text{Rh}_{0.92}\text{Pt}_{0.01})_{21.99}\text{Sb}_{0.50}\text{As}_{0.49}$ . A segregation ( $\leq 20 \mu\text{m}$ ) of the mineral is enclosed with hollingworthite and stibio-palladinite in an isoferroplatinum grain; Ir-Os alloys and tulameenite are nearby.

#### **(Rh,Ir)SbS**

Electron microprobe analysis gave Pt 1.90, Ir 27.00, Rh 16.87, Ru 0.08, Fe 0.01, As 0.98, Sb 43.33, S 9.71, sum 99.88 wt%, corresponding to  $(\text{Rh}_{0.57}\text{Ir}_{0.42}\text{Pt}_{0.03})_{21.02}\text{Sb}_{1.08}(\text{S}_{0.93}\text{As}_{0.03})_{20.96}$ , that is, a possible Rh analogue of tolovkite, with which it might form an isomorphous series.

#### **(Ni,Fe,Rh)S**

Four electron microprobe analyses of Rh-rich varieties gave the following ranges: Pt 0.70–1.20, Ir 6.54–7.21, Rh 26.50–28.20, Fe 15.60–17.80, Ni 10.10–11.60, Cu 4.05–4.71, Co 0.08–1.11, S 31.80–32.10, sum 99.72–100.39 wt%, corresponding to (one example)  $(\text{Fe}_{0.30}\text{Rh}_{0.29}\text{Ni}_{0.21}\text{Cu}_{0.07}\text{Ir}_{0.04}\text{Co}_{0.02}\text{Pt}_{0.01})_{20.94}\text{S}_{1.06}$ . An Ir-rich variety gave Pt 2.50, Ir 19.40, Rh 16.20, Fe 12.20, Ni 13.10, Cu 4.96, Co 0.63, S 30.20, sum 99.19 wt%, corresponding to  $(\text{Ni}_{0.26}\text{Fe}_{0.25}\text{Rh}_{0.18}\text{Ir}_{0.12}\text{Cu}_{0.08}\text{Pt}_{0.02})_{20.92}\text{S}_{1.08}$  per 2 apfu. In reflected light, brown with an olive tint. Forms segregations up to 70  $\mu\text{m}$  across in fractures and cavities in Pt-Fe alloys, (e.g., isoferroplatinum) and encloses 15- $\mu\text{m}$  crystals of rhodian pentlandite. Erlichmanite and Os-Ir-Pt alloys also are present.

#### **(Rh,Pt,Ir)<sub>3</sub>(Fe,Ni,Cu)<sub>3</sub>S<sub>8</sub>**

Electron microprobe analysis of a single grain gave Pt 20.66, Ir 6.14, Rh 21.23, Cu 2.48, Fe 9.40, Ni 8.55, S 29.89, sum 98.35 wt%, corresponding to  $(\text{Rh}_{0.88}\text{Pt}_{0.46}\text{Ir}_{0.14}$

$\text{Fe}_{0.73}\text{Ni}_{0.63}\text{Cu}_{0.17}\text{S}_{3.0}\text{S}_{4.0}$ . The mineral occurs in an isoferroplatinum grain and resembles platinum thiospinels.

**Discussion.**  $\text{Pd}_2\text{Sb}_3$  has also been reported to occur in Australia (abs. in *Am. Mineral.*, 78, p. 848 and 1111, 1993). For previous reports of possible  $\text{RhSbS}$ , see *Am. Mineral.*, 76, 1216–1217, 1989, and 78, p. 1111, 1993.  $(\text{Ni},\text{Ir},\text{Fe})\text{S}$  has been reported from the Thetford mines, Quebec (abs. in *Am. Mineral.*, 76, p. 1437, 1991).  $(\text{Rh},\text{Pt},\text{Ir})_3(\text{Fe},\text{Ni},\text{Cu})_3\text{S}_8$  seems to differ from the possible Fe analogue of cuprorhodsite,  $\text{FeRh}_2\text{S}_4$ . X-ray study is needed to clarify the nature of all these unnamed minerals. **E.S.G.**

**$(\text{Pd},\text{Cu})_2\text{Te}_3$ ,  $(\text{Pd},\text{Ag},\text{Ni})_3\text{Te}_4$ ,  $(\text{Pd},\text{Ni})_4\text{As}_3$**

R. Petrunov, P. Dragov, G. Ignatov, H. Neykov, Ts. Iliev, N. Vasileva, V. Tsatsov, S. Djunakov, K. Doncheva (1992) Hydrothermal PGE mineralization in the Elacite porphyry copper deposit (the Sredna Gora metallogenic zone, Bulgaria). *Doklady Bulg. Akad. Nauk.*, 45(4), 37–40.

The minerals occur in a fault zone up to 150 m wide in the main bornite + chalcopyrite + pyrite assemblage that forms the bulk of the commercial ore. The PGM and various sulfides and tellurides occur predominantly as grains of 1–20  $\mu\text{m}$ ; merenskyite (to 70  $\mu\text{m}$ ) is the most common of the PGM, and palladoarsenide is present as fewer and smaller grains. Also present are rammelsbergite, with 18.45 wt% Pd, and sparse amounts of three unnamed minerals as follows.

**$(\text{Pd},\text{Cu})_2\text{Te}_3$**

Electron microprobe analysis gave Pd 27.38, Pt 0.39, Fe 0.64, Cu 4.55, Te 65.45, Bi 0.83, S 0.75 wt%, corresponding to  $(\text{Pd}_{1.5}\text{Cu}_{0.4}\text{Fe}_{0.1})_{22.0}(\text{Te}_{2.9}\text{S}_{0.1})_{23.0}$ . White with a faint creamy tinge in reflected light, slightly anisotropic; reflectance close to that of merenskyite.

**$(\text{Pd},\text{Ag},\text{Ni})_3\text{Te}_4$**

Microprobe analysis (some interference from chalcopyrite) gave Pd 16.57, Ni 3.14, Fe 0.47, Ag 16.06, Cu 1.21, Te 61.91, S 0.65 wt%, corresponding to  $(\text{Pd}_{1.2}\text{Ag}_{1.2}\text{Ni}_{0.4}\text{Cu}_{0.1}\text{Fe}_{0.1})_{23.0}(\text{Te}_{3.8}\text{S}_{0.2})_{24.0}$ . Blue- to brown-tinged gray color in reflected light; strongly anisotropic, with polarization colors from brown to gray; reflectance similar to that of weissite.

**$(\text{Pd},\text{Ni},\text{Ag})_4\text{As}_3$**

Microprobe analysis gave Pd 61.95, Ni 1.10, Ag 1.48, Te 1.77, As 33.70 wt%, corresponding to  $(\text{Pd}_{3.78}\text{Ni}_{0.12}\text{Ag}_{0.09})_{23.99}(\text{As}_{2.92}\text{Te}_{0.09})_{23.01}$ . In reflected light, creamy pink, moderately anisotropic, reflectance between those of pyrite and chalcopyrite.

**Discussion.**  $\text{Pd}_4\text{As}_3$  has also been reported to occur in the Zechstein Cu deposits (*Am. Mineral.*, 74, p. 1219, 1989). **J.L.J.**

**$\text{Bi}_5\text{AuS}_4$ ,  $(\text{Bi},\text{Pb})_5\text{AuS}_4$ ,  $(\text{Bi},\text{Pb})_6\text{AuS}_4$ ,  $(\text{Bi},\text{Pb})_5\text{AuS}_3$ ,  $(\text{Bi},\text{Pb})_6\text{AuS}_3$ ,  $(\text{Bi},\text{Au})_4\text{S}_5$ ,  $(\text{Bi},\text{Au},\text{Pb})_6\text{S}_3$**

Z.N. Pavlova, V.L. Levin, B.M. Tasov (1991) New forms of occurrence of gold and bismuth in a copper-gold ore deposit of Kazakhstan. *Izvest. Akad. Nauk Kazakhskoy SSR*, 1991(3), 63–68 (in Russian).

The bismuth gold sulfides occur with arsenopyrite in low-sulfide quartz veins that cut hydrothermally altered diorites (locally, basic effusive rocks) in northwestern Kazakhstan. These sulfides, although not overly rare in this ore type, form grains not exceeding a few micrometers in diameter (maximum  $30 \times 50 \mu\text{m}$ ). Bismuth gold sulfides free of Pb are intergrown with  $\text{Bi}_3\text{Te}_{1.2}\text{S}_{0.8}$ , galena, native bismuth, and gold; less commonly with lead bismuth sulfosalts, cosalite, and maldonite. The bismuth gold sulfides, as well as the Au-Te-Bi mineral association as a whole, formed at the end of the hydrothermal process after arsenopyrite and the main mass of iron copper zinc sulfides. In reflected light, the bismuth gold sulfides (except those containing little Au) look the same and resemble cosalite and bismuthinite, differing from these by being pinkish or purplish (one nicol) and brownish to reddish (crossed nicols). Reflectances ( $R_1$ ,  $R_2$ ) are plotted from  $\lambda = 440$  to 740 nm for  $\text{Bi}_5\text{AuS}_4$ ,  $(\text{Bi},\text{Pb})_5\text{AuS}_4$ ,  $(\text{Bi},\text{Pb})_6\text{AuS}_4$ ,  $(\text{Bi},\text{Pb})_5\text{AuS}_3$ , and  $(\text{Bi},\text{Pb})_6\text{AuS}_3$ . Hardness suggested by relative relief is greater than that of joséite (90 kg/mm<sup>2</sup>) and galena (60–110), and less than that of cosalite (160).

**$\text{Bi}_5\text{AuS}_4$**

Electron microprobe analyses (average of five, pluses and minuses are deviations from the average) gave Bi 76.6, Au 13.8 (+0.9, –1.7), S 9.5 (+0.4, –0.4), sum 99.9 wt%, corresponding to  $\text{Bi}_{5.00}\text{Au}_{0.95}\text{S}_{4.05}$ .

**$(\text{Bi},\text{Pb})_5\text{AuS}_4$**

Electron microprobe analyses (average of 12) gave Bi 68.0, Pb 6, Fe 0.7, Au 14.9 (+0.5, –0.6), S 9.8 (+0.3, –0.4), sum 99.4 wt%, corresponding to  $(\text{Bi}_{4.36}\text{Pb}_{0.38}\text{Fe}_{0.18})_{24.92}\text{Au}_{1.00}\text{S}_{4.08}$ .

**$(\text{Bi},\text{Pb})_6\text{AuS}_4$**

Electron microprobe analyses (average of two) gave Bi 66.0, Pb 11, Fe 1.2, Au 13.2 (+0.1, –0.1), S 8.0 (+0.1, –0.2), sum 99.4 wt%, corresponding to  $(\text{Bi}_{4.92}\text{Pb}_{0.81}\text{Fe}_{0.33})_{26.06}\text{Au}_{1.05}\text{S}_{3.89}$ .

**$(\text{Bi},\text{Pb})_5\text{AuS}_3$**

Electron microprobe analyses (average of three) gave Bi 67.6, Pb 10, Fe 0.6, Au 14.3 (+0.2, –0.3), S 7.4 (+0.4, –0.5), sum 99.9 wt%, corresponding to  $(\text{Bi}_{4.26}\text{Pb}_{0.69}\text{Fe}_{0.11})_{25.06}\text{Au}_{0.96}\text{S}_{2.98}$ . Of the 11 X-ray diffraction lines obtained with a camera, only three are given: 2.405(50), 2.074(100), 1.810(30).

**$(\text{Bi},\text{Pb})_6\text{AuS}_3$**

Electron microprobe analyses (average of two) gave Bi 67.3, Pb 11, Fe 0.8, Au 13.6 (+0.2, –0.1), S 6.6 (+0.3,

–0.3), sum 99.3 wt%, corresponding to  $(\text{Bi}_{4.85}\text{Pb}_{0.80}\text{Fe}_{0.23})_{25.88}\text{Au}_{1.04}\text{S}_{3.08}$ .

#### $(\text{Bi,Au})_4\text{S}_5$

Electron microprobe analysis gave Bi 73.8, Au 4.6, S 14.9, sum 93.9 wt%, corresponding to  $(\text{Bi}_{3.78}\text{Au}_{0.25})_{24.03}\text{S}_{4.97}$ . In reflected light next to gold it resembles covellite in being bluish gray but differs by lacking anisotropic red colors.

#### $(\text{Bi,Au,Pb})_6\text{S}_3$

Electron microprobe analysis gave Bi 78.8, Pb 4, Fe 0.7, Au 9.3, S 7.7, sum 100.5 wt% (Co not given), corresponding to  $(\text{Bi}_{4.85}\text{Au}_{0.61}\text{Pb}_{0.24}\text{Fe}_{0.17}\text{Co}_{0.04})_{25.91}\text{S}_{3.09}$ . Almost identical to bismuthinite in reflected light.

**Discussion.** The low total for  $(\text{Bi,Au})_4\text{S}_5$  suggests that one or more constituents may have been overlooked during analysis of this compound.  $\text{Bi}_5\text{AuS}_4$  and  $(\text{Bi,Pb})_5\text{AuS}_4$  have been reported from other localities (*Am. Mineral.*, 75, 434–435, 1990) and may be related by an isomorphous Bi = Pb substitution. E.S.G.

#### $(\text{Co,Ni,Fe,Cu})\text{AsS}$

L.Ye. Gertsen, P.Ye. Kotel'nikov, Ye.Ya. Yeremeyeva (1991) Rare minerals of the Koksay porphyry copper ores. *Izvest. Akad. Nauk Kazakhskoy SSR, Ser. Geol.*, 1991(4), 51–58 (in Russian).

Electron microprobe analysis gave Cu 2.10, Fe 9.49, Co 12.78, Ni 12.65, As 44.73, S 18.51, sum 100.26 wt%, corresponding to  $(\text{Co}_{0.38}\text{Ni}_{0.37}\text{Fe}_{0.29}\text{Cu}_{0.06})_{21.10}\text{AsS}$ . Color is pinkish white; isotropic. Reflectance increases monotonically from 42 to 51% with increasing wavelength from 440 to 740 nm, whereas that of cobaltoan gersdorffite from Koksay is mostly 40–45% for 440–740 nm (reflectances estimated from plots). The mineral forms tabular, xenomorphic grains 1–6  $\mu\text{m}$  in diameter, intergrown with tennantite and enclosed in chalcopyrite in copper mineralization in the pre-Silurian Koksay intrusion, Dzhungar area, eastern Kazakhstan.

**Discussion.** The mineral is distinct from gersdorffite in that  $\text{Co} > \text{Ni}$  and  $\text{Co} > \text{Fe}$ , but X-ray study is needed to confirm the isometric symmetry and distinction from cobaltite, allocclastite, and glaucodot. E.S.G.

#### $\text{Na}_{1.23}\text{Ca}_{0.12}\text{Y}_{1.28}\text{REE}_{0.24}\text{F}_6$

Yu.K. Kabalov, Ye.V. Sokolova, A.P. Grigor'yev (1993) Determination of the crystal structure of the new mineral  $\text{Na}_{1.23}\text{Ca}_{0.12}\text{Y}_{1.28}\text{TR}_{0.24}\text{F}_6$  by the Rietveld method. *Doklady Akad. Nauk*, 330(6), 713–715 (in Russian).

Electron microprobe analysis (wt% not stated) gave the formula  $\text{Na}_{1.40}\text{Ca}_{0.22}(\text{Y}_{1.03}\text{La}_{0.01}\text{Ce}_{0.03}\text{Pr}_{0.01}\text{Nd}_{0.02}\text{Sm}_{0.01}\text{Gd}_{0.04}\text{Tb}_{0.02}\text{Dy}_{0.12}\text{Ho}_{0.02}\text{Er}_{0.10}\text{Yb}_{0.08})_{21.49}\text{F}_6$ , ideally  $(\text{Na,Ca})_{1.5}(\text{Y,REE})_{1.5}\text{F}_6$ . The mineral typically forms grains up to 0.5 mm in diameter intergrown with quartz. Col-

orless, or locally with delicate rose color. Brittle, vitreous luster,  $D_{\text{meas}} = 4.45$  (method not specified),  $D_{\text{calc}} = 4.52$   $\text{g/cm}^3$  for  $Z = 1$ . Optically uniaxial positive,  $\epsilon = 1.495$ ,  $\omega = 1.475$ . Powder X-ray data and the Rietveld method gave  $a = 5.9855(5)$ ,  $c = 3.5469(4)$  Å, space group  $P6_3/m$ , and structural formula  $\text{Na}_{0.87}(\text{Na}_{0.18}\text{Ca}_{0.06}\text{Y}_{0.64}\text{Ce}_{0.01}\text{Nd}_{0.01}\text{Gd}_{0.01}\text{Tb}_{0.01}\text{Dy}_{0.02}\text{Ho}_{0.01}\text{Er}_{0.03}\text{Yb}_{0.02})_2\text{F}_6$ . The mineral occurs with riebeckite, astrophyllite, zircon, and pyrochlore in alkaline quartz + albite + microcline metasomatites of the Araskan rare-earth deposit, south slope of the Sayan Range, Russia.

**Discussion.** The mineral is inferred to be isostructural with gagarinite-(Y) and related to it by an isomorphous series  $\text{NaCa}(\text{Y,REE})\text{F}_6\text{--Na}_{1.5}(\text{Y,REE})_{1.5}\text{F}_6$ . E.S.G.

#### $\text{K}_2(\text{NH}_4)\text{Mg}_3\text{Cl}_9 \cdot 18\text{H}_2\text{O}$

M.G. Siemann (1994) Ammonium bearing carnallite  $[(\text{K}|\text{NH}_4)\text{MgCl}_3 \cdot 6\text{H}_2\text{O}]$  in the salt mine Marie (Morleben). *Neues Jahrb. Mineral. Mon.*, 97–100.

The mineral occurs as a precipitate associated with ammonium-bearing carnallite in solution pools in the Marie salt mine near Helmstedt, Germany. Chemical analysis gave K 9.54,  $\text{NH}_4$  2.06, Mg 8.82, Cl 39.2,  $(\text{H}_2\text{O})_{\text{calc}}$  39.9 wt%, corresponding to  $\text{K}_2(\text{NH}_4)\text{Mg}_3\text{Cl}_9 \cdot 18\text{H}_2\text{O}$ ; also contains 0.06–0.08 wt% Br and about 0.15% Rb. Occurs as euhedral prismatic crystals, twinned parallel to elongation, brittle, conchoidal fracture, no cleavage, parting parallel to twinning,  $H = 2.5$ ,  $D_{\text{meas}} = 1.531$   $\text{g/cm}^3$ . Optically biaxial,  $\alpha = 1.480$ ,  $\beta = 1.482$ ,  $\gamma = 1.484$ . Orthorhombic or monoclinic symmetry with  $\beta$  close to  $90^\circ$ . The X-ray diffractometer pattern has strongest lines of 3.8268(47), 3.3178(100), 2.9670(44), 2.8165(41), 2.3464(39), and 1.9998(23) Å. J.L.J.

#### $\text{NaCa}_2\text{B}_9\text{O}_{14}(\text{OH})_4 \cdot 2\text{H}_2\text{O}$

N.A. Yamnova, Yu.K. Egorov-Tismenko, D.Yu. Pushcharovskii, S.V. Malinko, G.I. Dorokhova (1993) Crystal structure of a new natural  $\text{Na,Ca}$ -hydroborate  $\text{NaCa}_2[\text{B}_9\text{O}_{14}(\text{OH})_4] \cdot 2\text{H}_2\text{O}$ . *Kristallografiya*, 38, 71–76 (English transl. in *Crystallogr. Rep.*, 38, 749–752, formerly *Soviet Phys. Crystallogr.*).

The mineral occurs with howlite and colemanite in Miocene volcanic ash near the village of Bella Stena, southwest of Belgrade, Serbia. Chemical analysis gave  $\text{SiO}_2$  0.12,  $\text{Al}_2\text{O}_3$  0.05,  $\text{Fe}_2\text{O}_3$  0.05, MnO 0.01, MgO 0.02, SrO 0.09, CaO 21.73,  $\text{Na}_2\text{O}$  4.55,  $\text{K}_2\text{O}$  0.08,  $\text{B}_2\text{O}_3$  60.53,  $\text{H}_2\text{O}^+$  12.58, sum 99.97 wt%, corresponding to  $\text{Na}_2\text{O} \cdot 4\text{CaO} \cdot 9\text{B}_2\text{O}_3 \cdot 8\text{H}_2\text{O}$ . Color white, light gray to light yellow, vitreous luster, translucent to transparent,  $H = 5.7$ ,  $D_{\text{meas}} = 2.24\text{--}2.29$ ,  $D_{\text{calc}} = 2.34$   $\text{g/cm}^3$  for  $Z = 4$ . Optically biaxial negative,  $\alpha = 1.532$ ,  $\beta = 1.538$ ,  $\gamma = 1.564$ ,  $2V = 56^\circ$ . Single-crystal X-ray structure study ( $R = 0.051$ ) indicated monoclinic symmetry, space group  $P2_1/b$ ,  $a = 11.503(7)$ ,  $b = 10.53(1)$ ,  $c = 12.58(1)$  Å,  $\gamma = 99.48(7)^\circ$ . J.L.J.

**K-U vanadate**

P. Piret, G. Hentschel, M. Deliens, E. Van Der Meersche (1993) A carnotite-like potassium-uranylvanadate from the Schellkopf, Brenk, Eifel. *Aufschluß*, 44, 291–294 (in German).

The mineral occurs as rosettes, rarely as tabular single crystals, to 0.1 mm, on the Schellkopf phonolite, or associated with phillipsite, calcite, or fluorite. Qualitative electron microprobe analysis indicated the presence of K, U, and V. Single-crystal X-ray study gave monoclinic symmetry, space group  $P2_1/a$ ,  $a = 10.67$ ,  $b = 8.283$ ,  $c = 7.662$  Å,  $\beta = 102.8^\circ$ ; the cell parameters are close to those of  $M(UO_2)(VO_4)_2 \cdot 4H_2O$  compounds ( $M = Mn, Co, Ni$ ) which, however, are orthorhombic, space group  $Pnam$ . Strongest lines of the powder pattern (Cu radiation, 114-mm camera) are 7.47(10,001), 4.15(70,020), 3.75(40,002), 3.61(30,021), 3.27(60,220), 3.13(10, $\bar{2}$ 21), 3.01(60B,112; probable interference from the strongest line of calcite), and 2.836(10,221). The pattern is unlike that of carnotite. J.L.J.

**P analogue of molybdoformacite**

E.H. Nickel, G.J. Hitchen (1994) The phosphate analog of molybdoformacite from Whim Creek, Western Australia. *Mineral. Record*, 25, 203–204.

The mineral occurs sparingly as tufts, to 1 mm, of greenish yellow prismatic crystals up to 0.3 mm long and a few micrometers wide. Electron microprobe analysis gave PbO 61.2, CuO 10.5, MoO<sub>3</sub> 15.4, As<sub>2</sub>O<sub>3</sub> 1.0, CrO<sub>3</sub> 0.8, Ga<sub>2</sub>O<sub>3</sub> 0.1, P<sub>2</sub>O<sub>5</sub> 9.5, (H<sub>2</sub>O)<sub>calc</sub> 1.2, sum 99.7 wt%, corresponding to  $Pb_{2.03}Cu_{0.97}(Mo_{0.79}As_{0.06}Cr_{0.06}Ga_{0.01})_{20.92}(PO_4)_{0.99}O_{3.71}(OH)$ , ideally  $Pb_2Cu(Mo,As,Cr)O_4(PO_4)(OH)$ . Refractive indices  $> 2.0$ , length slow, high birefringence. The X-ray powder pattern is similar to that of molybdoformacite; by analogy and refinement  $a = 8.05$ ,  $b = 5.91$ ,  $c = 17.67$  Å,  $\beta = 109.7^\circ$ ,  $D_{calc} = 6.18$  g/cm<sup>3</sup> for  $Z = 4$ . Strongest lines (114-mm camera, Cu radiation) are 3.308(100, $\bar{2}$ 12), 2.950(50B,020), 2.814(40,114), 2.726(40,203), 2.332(30,220), and 1.895(30,304). Occurs with numerous other secondary minerals in the gossan at the Whim Creek Cu-Zn-Pb-Ag deposit, Pilbara region, northern Western Australia. J.L.J.

**New Data****Yingjiangite**

Jingyi Zhang, Anwa Wan, Wenshu Gong (1992) New data on yingjiangite. *Acta Petrologica Mineralogica*, 11(2), 178–184 (in Chinese, English abs.).

Chemical analysis of yingjiangite from the Xiazhuang uranium deposit, Guangdong Province, China, gave Na<sub>2</sub>O 0.15, K<sub>2</sub>O 3.37, MgO 0.10, CaO 2.00, MnO 0.03, Fe<sub>2</sub>O<sub>3</sub> 0.31, TiO<sub>2</sub> 0.09, SiO<sub>2</sub> 1.20, P<sub>2</sub>O<sub>5</sub> 10.50, UO<sub>3</sub> 75.42, H<sub>2</sub>O<sup>+</sup> 6.19, H<sub>2</sub>O<sup>-</sup> 0.25, sum 99.61 wt%, corresponding to  $K_{1.90}Na_{0.12}Ca_{0.95}(UO_2)_{7.02}(PO_4)_{3.93}(OH)_{6.16} \cdot 6.07H_2O$ . Electron microprobe analysis and DTA gave similar results, supporting the new formula  $(K_{2.3}Ca)(UO_2)_7(PO_4)_4(OH)_6 \cdot 6H_2O$ . Optically biaxial negative,  $2V = 36-38^\circ$ ,  $\alpha = 1.666(1)$ ,  $\beta = 1.703(2)$ ,  $\gamma = 1.707(2)$ . Single-crystal X-ray study indicated orthorhombic symmetry, space group  $Bmmb$ ,  $a = 15.707(3)$ ,  $b = 17.424(3)$ ,  $c = 13.692(2)$  Å;  $D_{meas} = 4.54$ ,  $D_{calc} = 4.60$  g/cm<sup>3</sup> for  $Z = 4$ . Strongest lines of the diffractometer powder pattern (Cu radiation) are 10.36(19,101), 7.89(100,200), 5.83(17,220), 3.94(50,400), 3.15(29,204), 3.09(14,052,143), and 2.878(16,252). J.L.J.

**Znucalite**

P.-J. Chiappero, H. Sarp (1993) New data and the second occurrence of znucalite. *Archs Sci. Genève*, 46, 291–301 (in French, English abs.).

Occurs as spherules to 350 μm in diameter in the oxidation zone of the Mas d'Alary uranium deposit near Lodève, Hérault, France. Crystals are elongate [001] and platy on (010), perfect {010} cleavage, nonluminescent, soluble in HCl,  $D_{meas} = 3.1$ ,  $D_{calc} = 3.15$  g/cm<sup>3</sup> for  $Z = 2$ . Electron microprobe analyses (range of 17) gave ZnO 51.16–56.60, CaO 3.29–3.76, UO<sub>3</sub> 17.10–19.92. Optically biaxial negative,  $\alpha = 1.556(2)$ ,  $\beta = 1.600(2)$ ,  $\gamma = 1.620(2)$ ,  $2V_{est} = 50-60^\circ$ ,  $2V_{calc} = 66^\circ$ ,  $X = c$ ,  $Y = b$ ,  $Z = a$ , parallel extinction. Partial single-crystal X-ray study indicated orthorhombic symmetry, and the cell was indexed with orthorhombic parameters  $a = 10.72(1)$ ,  $b = 25.16(1)$ ,  $c = 6.325(4)$  Å. Strongest lines of the powder pattern are 25.2(100,010), 6.27(60,040), 6.13(70,011), 5.642(50,021), 2.949(50,032,122), 2.718(70,360,280), and 2.702(90,190,271). The new cell and density lead to a formula of  $CaZn_{11}(UO_2)(CO_3)_3(OH)_{20} \cdot 4H_2O$  instead of the original  $CaZn_{12}(UO_2)(CO_3)_3(OH)_{22} \cdot 4H_2O$  (*Am. Mineral.*, 76, 1732–1733, 1991). J.L.J.

**Erratum**

Vol. 79, p. 387: The correct name is antimonselite.