

## NEW MINERAL NAMES\*

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### Arnhemite, pyrophosphite

J.E.J. Martini (1994) Two new minerals originated from bat guano combustion in Arnhem Cave, Namibia. Bull. South African Speleological Assoc., 33, 66–69.

#### Arnhemite

Occurs as flakes, up to 50  $\mu\text{m}$ , that form aggregates making up the principal component of a thin layer of white, friable slag in a profile of cave-floor soil. White color, pearly luster, soft, perfect {001} cleavage,  $D_{\text{meas}} = 2.35$ ,  $D_{\text{calc}} = 2.33 \text{ g/cm}^3$  for  $Z = 4$ . Insoluble in water, readily soluble in HCl. Optically uniaxial negative,  $\omega = 1.516$ ,  $\epsilon = 1.503$ . The average and range of 12 electron microprobe analyses ( $\text{H}_2\text{O}$  by gas chromatography) gave  $\text{Na}_2\text{O}$  4.48 (3.84–5.57),  $\text{K}_2\text{O}$  20.92 (17.50–22.03),  $\text{MgO}$  11.31 (10.27–12.25),  $\text{CaO}$  1.30 (0.88–2.46),  $\text{MnO}$  0.28 (0.20–0.33),  $\text{FeO}$  0.38 (0.07–0.67),  $\text{ZnO}$  0.18 (0.08–0.41),  $\text{P}_2\text{O}_5$  45.61 (43.95–46.94),  $\text{H}_2\text{O}$  14.70, sum 99.16 wt%, corresponding to  $(\text{K}_{2.78}\text{Na}_{0.91})_{\Sigma 3.69}(\text{Mg}_{1.76}\text{Ca}_{0.15}\text{Fe}_{0.03}\text{Mn}_{0.02}\text{Zn}_{0.01})_{\Sigma 1.97}\text{P}_{4.03}\text{O}_{13.89} \cdot 5.11\text{H}_2\text{O}$  for  $\text{O} = 19$ , ideally  $(\text{K},\text{Na})_4\text{Mg}_2(\text{P}_2\text{O}_7)_2 \cdot 5\text{H}_2\text{O}$ . The X-ray powder pattern consists of seven lines: 16.7(100,001), 8.33(15,011), 4.616(5,112), 3.184(5,030), 2.761(25,220), 2.300(10,224,042), and 2.216(5,126); indexing is based on a possible hexagonal cell with  $a = 11.06$ ,  $c = 16.75 \text{ \AA}$ . The new name is for the locality (see below).

#### Pyrophosphite

Twelve electron microprobe analyses gave an average of  $\text{Na}_2\text{O}$  1.02,  $\text{K}_2\text{O}$  29.10,  $\text{MgO}$  0.87,  $\text{CaO}$  19.11,  $\text{MnO}$  0.07,  $\text{FeO}$  0.07,  $\text{ZnO}$  0.05,  $\text{P}_2\text{O}_5$  49.15, sum 99.44 wt%, corresponding to  $(\text{K}_{1.79}\text{Na}_{0.10})_{\Sigma 1.89}(\text{Ca}_{0.99}\text{Mg}_{0.06})_{\Sigma 1.05}\text{P}_{2.00}\text{O}_{7.00}$ , ideally  $\text{K}_2\text{CaP}_2\text{O}_7$ . Occurs as anhedral, ovoid grains, up to 50  $\mu\text{m}$  across, in a matrix of arnhemite and archerite. White color, vitreous luster, soft, no cleavage observed,  $D_{\text{meas}} = 2.75$ ,  $D_{\text{calc}} = 2.76 \text{ g/cm}^3$  for  $Z = 4$ . Insoluble in water, readily soluble in HCl. Optically biaxial,  $\alpha = 1.543$ ,  $\gamma = 1.549$ . By analogy with the synthetic analog, monoclinic symmetry, space group  $P2_1/n$ ; indexing of the X-ray powder pattern (diffractometer,  $\text{CoK}\alpha$  radiation) gave  $a = 9.742$ ,  $b = 5.653$ ,  $c = 12.955 \text{ \AA}$ ,  $\beta = 104.35^\circ$ . Strongest lines are 4.32(32,20 $\bar{2}$ ), 3.137(33,004), 2.987(64,113), and 2.821(100,31 $\bar{1}$ ).

Arnhemite and pyrophosphite are the principal phases in a slag that forms a thin layer in a profile of soil at

Arnhem Cave, 150 km east of Windhoek, Namibia. Associated minerals are minor archerite, small grains of quartz and cristobalite, and fragments of carbon. The slag is interpreted to have resulted from the melting of ashes during the combustion of bat guano. Arnhemite formed subsequently by secondary hydration of an unknown precursor (see abstract for pyrocoprite). Arnhemite and pyrophosphite are in the Transvaal Museum, Pretoria, South Africa.

**Discussion.** Although data for arnhemite and pyrophosphite were submitted to the CNMMN prior to publication of the paper, neither proposal was approved.

**J.L.J.**

### Djerfisherite-thalfenisite analogs

A.Y. Barkov, K.V.O. Laajoki, S.A. Gehör, Y.N. Yakovlev, O. Taikina-Aho (1997) Chlorine-poor analogues of djerfisherite-thalfenisite from Noril'sk, Siberia and Salmagorsky, Kola Peninsula, Russia. Can. Mineral., 35, 1421–1430.

Electron microprobe analyses of djerfisherite, ideally  $\text{K}_6(\text{Fe},\text{Cu},\text{Ni})_{25}\text{S}_{26}\text{Cl}$ , showed that the Cl formula contents ranged from 1.03 to 0.02. A representative analysis of the three listed for the Cl-poor mineral gave K 7.70, Fe 35.71, Ni 2.37, Cu 18.63, S 33.60, Cl 0.03, sum 98.04 wt%, corresponding to  $\text{K}_{5.15}(\text{Fe}_{16.72}\text{Cu}_{7.67}\text{Ni}_{1.06})_{\Sigma 25.45}\text{S}_{27.39}\text{Cl}_{0.02}$ . The mineral, which seems to be a S-substituted analog of djerfisherite, occurs as inclusions 10–20  $\mu\text{m}$  across within djerfisherite that forms part of the sulfide-rich core of the Salmagorsky alkaline ultramafic complex, Kola Peninsula, northwestern Russia.

Electron microprobe analyses of a Cl-poor analog of thalfenisite, the latter ideally  $\text{Ti}_6(\text{Fe},\text{Ni},\text{Cu})_{25}\text{S}_{26}\text{Cl}$ , gave K 2.2, Ti 23.8, Pb 4.6, Fe 30.5, Ni 8.8, Cu 4.1, S 25.9, Cl not detected, sum 99.9 wt%, corresponding to  $(\text{Ti}_{3.83}\text{K}_{1.85}\text{Pb}_{0.73})_{\Sigma 6.41}(\text{Fe}_{17.96}\text{Ni}_{4.93}\text{Cu}_{2.12})_{\Sigma 25.01}\text{S}_{26.57}$ , which is the Cl-free analog of thalfenisite. Eight other listed analyses show extensive K-Ti substitution and maximum formula Cl = 0.13, suggesting complete solid solution between the Cl-poor analogs of thalfenisite and djerfisherite. These occur as subhedral to euhedral grains, typically triangular in cross-section and 5–30  $\mu\text{m}$  across, enclosed within chalcopyrite at the Oktyabrsky deposit, which is part of the Noril'sk complex, Siberia, Russia. **J.L.J.**

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

**Gwihabaite\***

J.E.J. Martini (1996) Gwihabaite— $(\text{NH}_4, \text{K})\text{NO}_3$ , orthorhombic, a new mineral from Gwihaba Cave, Botswana. *Bull. South African Speleological Assoc.*, 36, 19–21.

Gas chromatography and X-ray fluorescence analysis gave  $(\text{NH}_4)_2\text{O}$  25.09,  $\text{K}_2\text{O}$  10.40,  $\text{N}_2\text{O}_5$  61.44, sum 98.90 wt%, corresponding to  $[(\text{NH}_4)_{0.81}\text{K}_{0.19}]_{\Sigma 1.00}(\text{NO}_3)_{1.00}$ . The mineral occurs as saline crusts on boulders, and as slender needles and oolopholites, up to 5 mm long, that form efflorescences on the wall and earthy floor of a bat-inhabited cave in a dolomite hill in the Kalahari basin, 280 km west of Maun. Colorless, vitreous luster, transparent,  $H = \sim 2$ , no cleavage; crystals are acicular [001], showing {110}, {100}, and {111}. Highly soluble in water, deliquescent in a humid atmosphere,  $D_{\text{meas}} = 1.77$ ,  $D_{\text{calc}} = 1.79$  g/cm<sup>3</sup> for  $Z = 4$ . Optically colorless, biaxial negative,  $\alpha = 1.458$ ,  $\beta = 1.527$ ,  $\gamma = 1.599$ ,  $2V_{\text{meas}} = 90^\circ$ ,  $2V_{\text{calc}} = 87^\circ$ , no detectable dispersion. Orientation,  $X = b$ ,  $Y = a$ ,  $Z = c$ . Single-crystal X-ray study indicated orthorhombic symmetry, space group *Pbnm*,  $a = 7.075$ ,  $b = 7.647$ ,  $c = 5.779$  Å. Strongest lines of the powder pattern are 3.863(75,111), 3.364(85,120), 3.212(95,210), 3.194(100,021), and 2.595(90,220).

The mineral, which is derived through the bacterial decay of bat guano, is associated with gypsum, syngenite, boussingaultite, and dittmarite. The new name is for the locality, Gwihaba Cave, but has been slightly modified to aid pronunciation. Type material is in the Transvaal Museum, Pretoria, South Africa. **J.L.J.**

**Kenhsuite\***

J.K. McCormack, F.W. Dickson (1998) Kenhsuite,  $\gamma\text{-Hg}_3\text{S}_2\text{Cl}_2$ , a new mineral species from the McDermitt mercury deposit, Humboldt County, Nevada. *Can. Mineral.*, 36, 201–206.

Energy-dispersion analysis gave Hg 81.2 (79.2–86.2), S 9.4 (7.1–10.4), Cl 9.4 (6.6–10.3), sum 100 wt%, corresponding to  $\text{Hg}_3\text{S}_{2.17}\text{Cl}_{1.97}$ . Occurs as canary yellow fibers,  $1 \times 10$  μm, and as prismatic tablets and blades,  $1 \times 7 \times 25$  μm. Photosensitive, blackening within a few minutes on exposure to sunlight. Crystals are glassy, transparent, yellow streak,  $H = 2\text{--}3$ , brittle, hackly to conchoidal fracture, excellent cleavage [100], red to red-orange fluorescence in UV light at 366 nm,  $D_{\text{meas}}$  (synthetic) = 6.83,  $D_{\text{calc}} = 6.87$  g/cm<sup>3</sup> for  $Z = 8$ . Optically biaxial positive,  $2V = >70^\circ$ ,  $n_{\text{max}} = 2.24$ , parallel extinction, dispersion  $r \gg v$ , weakly pleochroic from pale yellow to greenish yellow in thick sections. White in reflected light. Orthorhombic symmetry by analogy with the synthetic analog, space group *A2mm*; refinement from the powder pattern of natural material gave  $a = 9.332(5)$ ,  $b = 16.82(2)$ ,  $c = 9.108(5)$  Å. Strongest lines are 3.65(90,122), 3.11(51,300), 2.60(49,331), 2.58(100,242), and 2.33(41,400), in good agreement with data for the synthetic counterpart.

The mineral occurs with cinnabar and corderoite, the latter the cubic polymorph of kenhsuite, as dispersed grains in montmorillonite, and as crystals and aggregates on fracture surfaces and in cavities, at the open pit of the inactive McDermitt Hg deposit near McDermitt, north-central Nevada. The new name is for Kenneth Hsu (b. 1929) of the Swiss Federal Institute of Technology, Zurich. Representative samples are in the Smithsonian Institution, Washington, and in the W.M. Keck Museum of the Mackay School of Mines, Reno, Nevada. **J.L.J.**

**Kentbrooksie\***

O. Johnsen, J.D. Grice, R.A. Gault (1997) Kentbrooksie from the Kangerdlugssuaq intrusion, East Greenland, a new Mn-REE-Nb-F end-member in a series within the eudialyte group: Description and crystal structure. *Eur. J. Mineral.*, 10, 207–219.

The mineral occurs as anhedral to subhedral aggregates up to 2 cm. Electron microprobe analysis gave  $\text{SiO}_2$  45.34,  $\text{ZrO}_2$  11.08,  $\text{Na}_2\text{O}$  14.51,  $\text{CaO}$  5.62,  $\text{FeO}$  1.58,  $\text{MnO}$  8.01,  $\text{K}_2\text{O}$  0.43,  $\text{La}_2\text{O}_3$  2.23,  $\text{Ce}_2\text{O}_3$  2.44,  $\text{Nd}_2\text{O}_3$  0.69,  $\text{Y}_2\text{O}_3$  1.46,  $\text{Nb}_2\text{O}_5$  2.26,  $\text{Al}_2\text{O}_3$  0.21,  $\text{SrO}$  0.49,  $\text{TiO}_2$  0.56,  $\text{HfO}_2$  0.36,  $\text{MgO}$  0.06,  $\text{Cl}$  0.29,  $\text{F}$  0.88,  $\text{H}_2\text{O}$  by CHN 1.28,  $\text{O} \equiv \text{Cl} + \text{F}$  0.44, sum 99.34 wt%, corresponding to  $(\text{Na}_{14.93}\text{REE}_{0.44}\text{Y}_{0.42}\text{K}_{0.30}\text{Sr}_{0.15})_{\Sigma 16.24}(\text{Ca}_{3.27}\text{Mn}_{1.78}\text{REE}_{0.62}\text{Na}_{0.33})_{\Sigma 6.00}(\text{Mn}_{1.90}\text{Fe}_{0.72}\text{Al}_{0.13}\text{Mg}_{0.05})_{\Sigma 2.80}(\text{Nb}_{0.55}\text{Zr}_{0.12}\text{Ti}_{0.10})_{\Sigma 0.77}\text{Si}_{1.60}(\text{Zr}_{2.81}\text{Hf}_{0.06}\text{Ti}_{0.13})_{\Sigma 3}[(\text{Si}_3\text{O}_9)_2(\text{Si}_9\text{O}_{27})_2\text{O}_2](\text{F}_{1.51}\text{Cl}_{0.27}\text{OH}_{0.22})_{\Sigma 2} \cdot 2.3\text{H}_2\text{O}$ , simplified as  $(\text{Na}, \text{REE})_{15}(\text{Ca}, \text{REE})_6\text{Mn}_3\text{Zr}_3\text{NbSi}_{25}\text{O}_{74}\text{F}_2 \cdot 2\text{H}_2\text{O}$ . Yellow-brown color, vitreous luster, transparent, white streak, brittle, uneven fracture, no cleavage,  $H = 5\text{--}6$ , nonfluorescent, strongly pyroelectric,  $D_{\text{meas}} = 3.10(4)$ ,  $D_{\text{calc}} = 3.08$  g/cm<sup>3</sup> for  $Z = 3$ . Optically uniaxial negative, nonpleochroic,  $\omega = 1.628(2)$ ,  $\epsilon = 1.623(2)$ . Single-crystal X-ray structure study ( $R = 0.041$ ) indicated trigonal symmetry, space group *R3m*,  $a = 14.1686(2)$ ,  $c = 30.0847(4)$  Å as refined from diffractometer powder data ( $\text{CuK}\alpha_1$ ). Strongest lines of the powder pattern are 11.385(43,101), 7.088(41,110), 5.682(30,202), 4.295(34,205), 3.380 (37,131), 2.961(91,315), and 2.839(100,404).

The mineral occurs in alkaline pegmatites that cut nepheline syenite at the Kangerdlugssuaq intrusion. The new name is for geologist C. Kent Brooks. Type material is in the Geological Museum of the University of Copenhagen, and in the Canadian Museum of Nature, Ottawa. The mineral represents the  $\Sigma\text{Nb}, \text{REE}, \text{Mn}, \text{F}$  end-member of a series within the eudialyte group **J.L.J.**

**Mitryaevaite\***

E.A. Ankinovich, G.K. Bekenova, T.A. Shabanova, I.S. Zazubina, S.M. Sandomirskaya (1997) Mitryaevaite,  $\text{Al}_{10}[(\text{PO}_4)_{8.7}(\text{SO}_3\text{OH})_{1.3}]_{\Sigma 10}\text{AlF}_3 \cdot 30\text{H}_2\text{O}$ , a new mineral species from a Cambrian carbonaceous chert formation, Karatau Range and Zhabagly Mountains, southern Kazakhstan. *Can. Mineral.*, 35, 1415–1419.

Wet-chemical analysis gave  $\text{CaO}$  0.90,  $\text{Al}_2\text{O}_3$  30.00,

Fe<sub>2</sub>O<sub>3</sub> 0.30, P<sub>2</sub>O<sub>5</sub> 32.40, SO<sub>3</sub> 5.50, F 3.00, H<sub>2</sub>O<sup>-</sup> 1.90, H<sub>2</sub>O<sup>+</sup> 27.80, O≡ F 1.27, sum 100.53 wt%, corresponding to Al<sub>10.08</sub>(PO<sub>4</sub>)<sub>8.71</sub>(SO<sub>3</sub>OH)<sub>1.29</sub>Al(F<sub>2.97</sub>OH<sub>0.03</sub>)<sub>Σ3.00</sub>·29.63H<sub>2</sub>O. The mineral occurs as white to colorless powdery coatings, as fine-grained subparallel and complex dendritic veinlets, and as globular nodules and bulbous surfaces to 0.8 cm across. White to colorless, dull to vitreous luster, white streak, perfect {001} and good {010} and {100} cleavages, *H* not determinable, slowly soluble in cold acids, *D*<sub>meas</sub> = 2.02, *D*<sub>calc</sub> = 2.033 g/cm<sup>3</sup> for *Z* = 1. Microcrystals are prismatic and up to 0.04 mm in diameter. Optically biaxial, positive elongation, α = 1.504(1), γ = 1.515(1), γ ∧ *b* = 14°. Electron diffraction patterns indicated triclinic symmetry, space group *P1* or *P1̄*; *a* = 6.92(1), *b* = 10.09(1), *c* = 22.46(6) Å, α = 92.42(4), β = 96.43(7), γ = 104.3(2)° as refined from a diffractometer powder pattern (CuKα radiation) with strongest lines of 9.75(100,010), 9.24(20,011̄), 6.35(30,110), 3.333(20,200), 3.222(20,201), and 2.923(20,210).

The mineral is associated with minyulite, crandallite, gypsum, and other sulfates and phosphates that formed by weathering of vanadiferous, carbonaceous shale. The new name is for Kazakhstan mineralogist N.M. Mityayeva (b. 1920). Type material is in the Geological Museum of the Satpaev Institute of Geological Sciences, Almaty, Kazakhstan. **J.L.J.**

#### Nenadkevichite, Ti analog

R.K. Rastsvetaeva, N.V. Chukanov, I.V. Pekov (1997) Crystal structure of a new mineral, the titanium analog of orthorhombic nenadkevichite. Doklady Akad. Nauk, 357(3), 364–367 (in Russian).

The mineral occurs as colorless, prismatic crystals, to 1 cm, in the albite zone of a pegmatite at Mt. Alluaiv, Kola Peninsula, Russia. Electron microprobe analysis (not given) corresponds to Na<sub>2.88</sub>(Ti<sub>1.40</sub>Nb<sub>0.52</sub>Zr<sub>0.02</sub>Fe<sub>0.02</sub>)<sub>Σ1.98</sub>[Si<sub>4</sub>O<sub>12</sub>]O<sub>1.2</sub>(OH<sub>0.8</sub>)·~2H<sub>2</sub>O. Single-crystal X-ray structure study (*R* = 0.048) indicated orthorhombic symmetry, space group *Pbam*, *a* = 7.350(1), *b* = 14.153(3), *c* = 7.124(2) Å, *D*<sub>meas</sub> = 2.63 g/cm<sup>3</sup>, *Z* = 2. The mineral is associated with aegirine, lorenzenite, sphalerite, epididymite, leifite, shortite, sidorenkite, quartz, rhodochrosite, and pyrrhotite, and is commonly epitaxially grown on epididite. **J.L.J.**

#### Polkanovite\*

S.N. Britvin, N.S. Rudashevsky, A.N. Bogdanova, D.K. Shcherbachov (1998) Polkanovite Rh<sub>12</sub>As<sub>7</sub>—a new mineral from a placer at the Miass River (South Urals). Zapiski Vseross. Mineral. Obshch., 127(2), 60–62 (in Russian, English abs.).

The mean of nine electron microprobe analyses listed gave Ru 2.9, Rh 54.3, Pd 2.0, Os 0.7, Ir 0.7, Pt 0.4, Ni 7.0, As 31.7, sum 99.7 wt%, corresponding to (Rh<sub>8.90</sub>Ni<sub>2.01</sub>Ru<sub>0.48</sub>Pd<sub>0.32</sub>Os<sub>0.06</sub>Ir<sub>0.06</sub>Pt<sub>0.03</sub>)<sub>Σ11.86</sub>As<sub>7.13</sub>, ideally Rh<sub>12</sub>As<sub>7</sub>. Oc-

curs as grains up to 45 × 140 μm; metallic luster, no cleavage or parting observed, *VHN*<sub>40</sub> = 399–422 (410), *D*<sub>calc</sub> = 10.20 g/cm<sup>3</sup> for *Z* = 1. Brownish gray in reflected light, weakly anisotropic from gray to brownish gray. Maximum and minimum reflectance percentages in air are given in 20 nm steps from 400 to 700 nm; representative values are 47.5, 43.9 (460), 47.8, 44.5 (480), 49.2, 46.4 (580), 49.7, 46.9 (600), 51.3, 47.8 (640), and 51.3, 48.6 (660). Indexing of the X-ray powder pattern (114 mm Debye–Scherrer, FeKα) by analogy with data for synthetic Rh<sub>12</sub>As<sub>7</sub> indicated hexagonal symmetry, space group *P6<sub>3</sub>/m*, *a* = 9.31(2), *c* = 3.64(2) Å; strongest lines are 2.33(40,211), 1.852(90,320), 1.767(60,401), 1.755(100,410), and 1.549(80,330).

The mineral occurs in the 0.05–1.5 mm fraction of gold-placer washings consisting of about 70 wt% chromite and ilmenite, 30% Ru–Os–Ir alloys, and about 1% isoferroplatinum. Polkanovite is intergrown with isoferroplatinum and tulameenite within native ruthenium. Associated minerals are cherepanovite, irarsite, and unnamed RhNiAs, Rh<sub>2</sub>As, and (Pd,Rh)<sub>2</sub>As. The new name is for Yu. A. Polkanov of the Institute of Mineral Resources, Academy of Technical Sciences of the Ukraine. Type material is in the Mining Museum of the Saint Petersburg Mining Institute, Russia. **J.L.J.**

#### Potassicpargasite\*

G.W. Robinson, J.D. Grice, R.A. Gault, A.E. Lalonde (1997) Potassicpargasite, a new member of the amphibole group from Pargas, Turku-Pori, Finland. Can. Mineral., 35, 1535–1540.

Electron microprobe and wet-chemical analyses gave SiO<sub>2</sub> 41.63, TiO<sub>2</sub> 0.87, Al<sub>2</sub>O<sub>3</sub> 13.13, Fe<sub>2</sub>O<sub>3</sub> 2.20, FeO 11.00, MgO 11.86, MnO 0.16, CaO 12.33, K<sub>2</sub>O 2.83, Na<sub>2</sub>O 1.55, H<sub>2</sub>O 0.90, F 1.78, O≡ F 0.75, sum 99.49 wt%, corresponding to (K<sub>0.54</sub>Na<sub>0.44</sub>)<sub>Σ0.98</sub>(Ca<sub>1.99</sub>Na<sub>0.01</sub>)<sub>Σ2.00</sub>(Mg<sub>2.66</sub>Fe<sub>1.38</sub><sup>2+</sup>Al<sub>0.59</sub>Fe<sub>0.25</sub><sup>3+</sup>Ti<sub>0.10</sub>Mn<sub>0.02</sub>)<sub>Σ5.00</sub>(Si<sub>6.26</sub>Al<sub>1.74</sub>)<sub>Σ8.00</sub>O<sub>22</sub>[(OH)<sub>0.90</sub>F<sub>0.85</sub>O<sub>0.25</sub>]<sub>Σ2.00</sub>, ideally (K,Na)Ca<sub>2</sub>(Mg,Fe,Al)<sub>5</sub>(Si,Al)<sub>8</sub>O<sub>22</sub>(OH,F)<sub>2</sub>. Occurs as intergrown crystals, up to 2 × 1 × 0.7 cm, elongate [100] and slightly tabular on {010}, showing {110}, {011}, {010}, with minor {100}, {101}, and several other forms. Black and opaque in hand specimen, translucent in splinters, brownish green streak, *H* = 6–6½, brittle, conchoidal to uneven fracture, perfect {110} cleavage, nonfluorescent, *D*<sub>meas</sub> = 3.25, *D*<sub>calc</sub> = 3.25 g/cm<sup>3</sup> for *Z* = 2. Optically biaxial negative, β = 1.654(1), β = 1.664(1), γ = 1.670(1), 2*V*<sub>z</sub> = 101(1), 2*V*<sub>calc</sub> = 105°, *Y* = *b*, *X* ∧ *a* = 40° (β obtuse), pleochroism *X* = pale gray-green, *Y* = olive green, *Z* = dark olive green, *Z* > *Y* > *X*. Single-crystal X-ray structure study (*R* = 0.036) indicated monoclinic symmetry, space group *C2/m*, *a* = 9.9199(4), *b* = 18.0591(8), *c* = 5.3180(3) Å, β = 105.36(1)° as refined from a diffractometer powder pattern (CuKα radiation) with strongest lines of 8.45(95,110), 3.283(45,240), 3.140(100,310), 2.707(35,151), 2.344(70,421), 2.108(35,351), and 1.652(40,461).



The holotype specimen is associated with calcite and is thought to be from Pargas, Turku-Pori, Finland; the mineral is also known to occur in other samples from Pargas, and from localities in Scotland, Japan, and Antarctica. The name complies with current IMA nomenclature. Type material is in the Canadian Museum of Nature, Ottawa. **J.L.J.**

**Protoferro-anthophyllite\*, protomangano-ferro-anthophyllite\***

S. Sueno, S. Matsuura, G.V. Gibbs, M.B. Boisen Jr. (1998) A crystal chemical study of protoanthophyllite: orthoamphiboles with the protoamphibole structure. *Phys. Chem. Minerals*, 25, 366–377.

The minerals were approved by the CNMMN in 1986, but were then suspended pending the now-published update on nomenclature by the Subcommittee on Amphiboles. With the authors' permission, some information from the original CNMMN submissions is included in the following abstracts.

**Protoferro-anthophyllite**

The mineral occurs as sheaf-like aggregates of acicular crystals to 3 mm length, elongate [001], in pegmatites at the Cheyenne Mountain area, El Paso County, Colorado, and at Hirukawa Village, Gifu Prefecture, Japan. Electron microprobe analysis (three listed) gave SiO<sub>2</sub> 46.27, FeO 46.39, MnO 2.51, MgO 0.12, CaO 0.09, sum 95.38 wt% (Cheyenne), corresponding to (Fe<sub>6.67</sub>Mn<sub>0.37</sub>Mg<sub>0.03</sub>Ca<sub>0.02</sub>)<sub>Σ7.09</sub>Si<sub>7.96</sub>O<sub>22</sub>(OH)<sub>2</sub>. Light brownish yellow color, vitreous luster, transparent, white streak, perfect {210} cleavage, *H* not determined, *D*<sub>calc</sub> = 3.61 g/cm<sup>3</sup> for *Z* = 2. Optically biaxial negative, α = 1.690, β = 1.710, γ = 1.726, 2*V* = 87°, *X* = *a*, *Y* = *b*, *Z* = *c*, weakly pleochroic with *X*, *Y*, *Z* pale yellow. Single-crystal X-ray structure study (*R* = 0.05) indicated orthorhombic symmetry, space group *Pnmm*, *a* = 9.382(2), *b* = 18.390(4), *c* 5.343(1) Å. A calculated X-ray diffraction pattern is illustrated; strongest lines are 8.353(100,110), 3.277(33,240), 3.074(64,310), 2.560(92,102,161), and 2.317(31,202).

The mineral occurs in blocks of fayalite, and some grains enclose magnetite in association with quartz, anorthite, and laihunite; also associated with clinoamphibole at Cheyenne, but not Japan. The name indicates the structural relationship to protoamphiboles, and the compositional relationship to anthophyllite. Type material is in the University Museum of the University of Tokyo, in the American Museum of Natural History, New York, and in the Smithsonian Institution, Washington.

**Protomangano-ferro-anthophyllite**

The mineral occurs abundantly in the bedded Mn deposit at Yokoneyama, Tochigi Prefecture, Japan; also found in a pegmatite at Suishoyama, Fukushima Prefecture, Japan. Crystals are in sheaf-like aggregates, acicular [001] and up to 10 mm long. Light brownish yellow to

white color, vitreous luster, transparent, white streak, *H* = 5–6, perfect {210} cleavage, *D*<sub>calc</sub> = 3.50 g/cm<sup>3</sup> for *Z* = 2. Optically biaxial negative, α = 1.695, β = 1.714, γ = 1.731, 2*V* = 76°, orientation and pleochroism as in protoferro-anthophyllite. Electron microprobe analysis (one of two listed) gave, for the Yokoneyama mineral, SiO<sub>2</sub> 48.99, Al<sub>2</sub>O<sub>3</sub> 0.17, FeO 34.44, MnO 9.98, MgO 3.69, CaO 0.16, sum 97.43 wt%, corresponding to (Fe<sub>4.69</sub>Mn<sub>1.38</sub>Mg<sub>0.90</sub>Ca<sub>0.03</sub>)<sub>Σ7.00</sub>(Si<sub>7.98</sub>Al<sub>0.03</sub>)<sub>Σ8.01</sub>O<sub>22</sub>(OH)<sub>2</sub>, structurally approximating (Mn<sub>0.70</sub>Fe<sub>0.30</sub>)<sub>2</sub>(Fe<sub>0.82</sub>Mg<sub>0.18</sub>)<sub>5</sub>(Si<sub>4</sub>O<sub>11</sub>)<sub>2</sub>(OH)<sub>2</sub>. Single-crystal X-ray structure study (*R* = 0.04) gave orthorhombic symmetry, space group *Pnmm*, *a* 9.425(2), *b* = 18.303(4), *c* 5.345(1) Å. A calculated X-ray diffraction pattern is illustrated; strongest lines of the powder pattern are 8.366(92,110), 3.285(55,240), 3.098(100,310), 2.881(29,151), and 2.548(58,161, 251, 112). As with protoferro-anthophyllite, single-crystal study may be required for an unequivocal identification.

At the Yokoneyama Mn deposit, the mineral is present as transparent prisms and opaque, fibrous white crystals associated with spessartine, rhodochrosite, and pyroxmangite. In the Suishoyama pegmatite occurrence, the mineral is mixed with clinoamphiboles. The new name, which alludes to the structural and compositional relationship to other amphiboles, conforms to approved nomenclature for the amphibole group. Type material is in the Institute of Science, University of Tsukuba, Japan, and in the Museum of the Geological Survey of Japan. **J.L.J.**

**Pushcharovskite\***

H. Sarp, J. Sanz-Gysler (1997) Pushcharovskite, Cu(AsO<sub>3</sub>,OH)·H<sub>2</sub>O, a new mineral from the Cap Garonne mine, Var (France). *Archs Sci. Genève*, 50, 177–186 (in French, English abs.).

Electron microprobe analysis gave CuO 35.70, As<sub>2</sub>O<sub>5</sub> 52.31, H<sub>2</sub>O (loss on heating) 12.0, sum 100.01 wt%, corresponding to Cu<sub>1.00</sub>As<sub>1.01</sub>H<sub>2.96</sub>O<sub>5</sub>, ideally Cu(AsO<sub>3</sub>,OH)·H<sub>2</sub>O. Occurs as colorless to light green tufts and acicular, radial fibrous aggregates to 1 mm in diameter. Individuals are elongate [100] to 0.5 mm, flattened on (010) to 0.04 mm width, showing {010}. Transparent, vitreous luster, white streak, fragile, perfect {010} and good {001} cleavages, *H* not determinable, polysynthetically twinned on (010), nonfluorescent, soluble in dilute HCl, *D*<sub>meas</sub> = 3.35(2), *D*<sub>calc</sub> = 3.34(1) g/cm<sup>3</sup> for *Z* = 12. Optically biaxial positive, α = 1.602(2), β = 1.642(2), γ = 1.725(5), 2*V*<sub>meas</sub> = 70(3)°, 2*V*<sub>calc</sub> = 73(1)°, dispersion *r* > *v* medium, nonpleochroic, on (010) *Z* ∧ *a* = 18.4°. Single-crystal X-ray study indicated triclinic symmetry, space group *P1* or *P1̄*, *a* = 6.435(2), *b* = 11.257(4), *c* = 18.662(9) Å, α = 74.90(6), β = 86.48(7), γ = 83.59(4)° as refined from a 114 mm Gandolfi powder pattern (CuKα radiation) with strongest lines of 18.3(25,001), 11.00(100,010), 3.171(30,201), 2.952(50,211,131,211), 2.920(60,221), 2.816(50,016), and 2.492(25,026).

The mineral, which is a polymorph of geminite, is an oxidation product associated with tennantite, covellite, geminite, lindackerite, yvonite, and mahnertite in quartz gangue at the Cap Garonne Cu-Pb mine, Var, France; also reported in association with geminite and yvonite at the Salsigne mine, Aude, France. The new name is for Dmitry Pushcharovsky, Moscow State University. Type material is in the Department of Mineralogy, Natural History Museum of Geneva, Switzerland. **J.L.J.**

### Pyrocoproite

J.E.J. Martini (1997) Pyrocoproite ( $\text{Mg}(\text{K},\text{Na})_2\text{P}_2\text{O}_7$ , monoclinic), a new mineral from Arnhem Cave (Namibia), derived from bat guano combustion. Proceedings 12<sup>th</sup> Internat. Congress of Speleology, La Chaux de Fonds, Switzerland, 233–235.

Electron microprobe analyses gave  $\text{Na}_2\text{O}$  4.44,  $\text{K}_2\text{O}$  27.13,  $\text{MgO}$  14.44,  $\text{CaO}$  1.21,  $\text{P}_2\text{O}_5$  53.09, sum 100.31 wt%, corresponding to  $(\text{K}_{1.55}\text{Na}_{0.38})_{\Sigma 1.93}(\text{Mg}_{0.96}\text{Ca}_{0.06})_{\Sigma 1.02}\text{P}_{2.007}\text{O}_7$ , ideally  $(\text{K},\text{Na})_2\text{MgP}_2\text{O}_7$ . Occurs with arnhemite and pyrophosphate (see preceding abstracts) in a white, friable slag that forms a thin layer in soil in the Arnhem Cave. Pyrocoproite, which is concluded to be the anhydrous precursor of arnhemite, occurs as anhedral grains to 10  $\mu\text{m}$  across. Colorless,  $H$  not determinable, no cleavage,  $D_{\text{meas}} = 2.96$ ,  $D_{\text{calc}} = 2.98 \text{ g/cm}^3$  for  $Z = 4$ ; insoluble in water, but readily soluble in strong acids. Optically weakly birefringent,  $\alpha = 1.558$ ,  $\gamma = 1.560$ . The X-ray powder pattern, indexed by analogy to that of pyrophosphate, gave monoclinic symmetry,  $a = 9.410$ ,  $b = 5.424$ ,  $c = 12.540 \text{ \AA}$ ,  $\beta = 104.35^\circ$ . Strongest lines are  $4.55(63,11\bar{1})$ ,  $4.18(40,20\bar{2})$ ,  $3.040(46,004)$ ,  $2.882(94,20\bar{4},113)$ ,  $2.714(100,31\bar{1})$ , and  $2.091(40,222,40\bar{4})$ .

The new name alludes to the genesis by the combustion of guano. Type material is in the Geological Survey of Namibia, Windhoek.

**Discussion.** Pyrocoproite, unlike arnhemite and pyrophosphate (which see), has not been submitted to the CNMMN for a vote. The mineralogical community is not well-served by the publication of such names. **J.L.J.**

### $\text{Cu}_2\text{Fe}_3\text{Zn}_5\text{S}_{10}$

N.N. Mozgova, S.G. Krasnov, Yu. S. Borodaev, T.V. Stepanova, G.A. Cherkashev, C. Lalou, M.S. Samovarov (1998) The structure, mineral associations, and noble metals of the Mir oceanic ore mound, the TAG hydrothermal field (Mid-Atlantic Ridge, 26°N latitude). *Geology Ore Deposits*, 40(3), 228–249.

Ten electron microprobe analyses are listed for a mineral that occurs as strongly anisotropic platy crystals <10  $\mu\text{m}$  across. The analyses with the lowest and highest Cu are, respectively, Cu 12.10, 18.56, Fe 18.27, 20.97, Zn 35.29, 26.51, Ag 0.16, 0.09, S 34.38, 35.02, sum 100.20, 101.15 wt% corresponding to  $(\text{Cu}_{1.80}\text{Ag}_{0.01})_{\Sigma 1.81}(\text{Zn}_{5.10}\text{Fe}_{3.09})_{\Sigma 8.19} \text{S}_{10.13}$  and  $(\text{Cu}_{2.72}\text{Ag}_{0.01})_{\Sigma 2.73}(\text{Zn}_{3.77}\text{Fe}_{3.50})_{\Sigma 7.27}\text{S}_{10.17}$

empirically  $(\text{Cu}_{2+x}\text{Fe}_{3+y}\text{Zn}_{5-x-y})_{10}\text{S}_{10}$ . The mineral is associated with acanthite in the central part of sphalerite nodules from the Mir sulfide mound, whose sulfide minerals are mainly pyrite, marcasite, chalcopyrite, and sphalerite. **J.L.J.**

### Ru-Os-Ir-Fe oxides

G. Garuti, F. Zaccarini, R. Cabella, G. Fershtater (1997) Occurrence of unknown Ru-Os-Ir-Fe oxides in the chromitites of the Nurali ultramafic complex, southern Urals, Russia. *Can. Mineral.*, 35, 1431–1439.

The minerals occur as inclusions, 5–35  $\mu\text{m}$ , typically in the rim of chromite crystals. Of the 11 electron microprobe analyses listed, the highest in Os gave  $\text{OsO}_2$  84.20,  $\text{Fe}_2\text{O}_3$  8.97, NiO 4.20, CuO 1.94, sum 99.31 wt%; the highest in Ir gave  $\text{OsO}_2$  15.64,  $\text{IrO}_2$  24.49,  $\text{RuO}_2$  30.37,  $\text{RhO}_2$  0.16,  $\text{PdO}_2$  0.33,  $\text{Fe}_2\text{O}_3$  26.61, NiO 1.85, Cu 0.09, sum 99.54 wt%. Compositions generally range between  $\text{XO}_2$  and  $\text{X}_2\text{O}_3$ , with  $(\text{Ru} + \text{Os} + \text{Ir})/(\text{Fe} + \text{Ni} + \text{Cu})$  ranging from 5 to 1. Yellowish gray color in reflected light,  $VHN = 339$ – $446$ , strong birefractance, strong anisotropism resembling that of graphite; reflectance percentages in air at 548.3 nm are 25–27 for  $R_1$  and 28–38 for  $R_2$ . The minerals, which occur in the Nurali complex, 45 km southwest of Miass, Russia, are considered to have formed by desulfurization of laurite-erlichmanite during a hydrothermal event. **J.L.J.**

### $\text{Au}_2\text{SbO}_2(\text{OH})$

Z. Johan, V. Šrein (1998) A new natural oxide of Au and Sb. *C.R. Acad. Sci. Paris, Series Earth and Planetary Sci.*, 326, 533–538 (in French, abridged English).

The average and range for the four electron microprobe analyses listed are Au 68.32 (67.63–68.79), Sb 21.26 (20.92–22.13), As 0.30 (0.08–0.45), Cu 0.10 (0–0.27), Si 0.21 (0.14–0.28), O 8.44 (8.11–8.83), sum 98.63 (97.99–99.87) wt%, corresponding to  $(\text{Au}_{0.677}\text{Cu}_{0.003}\text{Sb}_{0.341}\text{As}_{0.008})_{\Sigma 1.029}\text{O}$ , possibly  $\text{Au}_2^+\text{Sb}^{3+}\text{O}_2(\text{OH})$ . The mineral occurs as <40  $\mu\text{m}$  zoned rims on aurostibite, and as veinlets within it. In reflected light, the oxide is brownish gray to pinkish brown, with a reflectivity similar to that of goethite, and with pleochroism and anisotropy not observed. A Debye-Scherrer X-ray powder pattern indicated that the mineral is amorphous. The occurrence is in pyrite-arsenopyrite-quartz tailings at the Nova mine at Krásná Hora, near Příbram, Czech Republic. The oxide is considered to have formed by hydrothermal alteration of aurostibite rather than from in-situ oxidation. **J.L.J.**

### New data

#### Haiweeite

R.K. Rastsvetaeva, A.V. Arakcheeva, D.Yu. Pushcharovsky, D. Atencio, L.A.D. Menezes Filho (1997) New

silicon band in the haiweeite [sic] structure. *Crystallogr. Reports*, 42(6), 927–933.

Single-crystal X-ray structure study ( $R = 0.118$ ) of haiweeite from Teofilo Otoni, Minas Gerais, Brazil, gave orthorhombic symmetry, space group  $P2_12_12_1$ ,  $a = 14.263(3)$ ,  $b = 17.988(3)$ ,  $c = 18.395(3)$  Å,  $D_{\text{calc}} = 2.86$  g/cm<sup>3</sup> for  $Z = 8$  and the new formula  $\text{Ca}(\text{UO}_2)_2[\text{Si}_5\text{O}_{12}(\text{OH})_2] \cdot 4.5\text{H}_2\text{O}$ .

**Discussion.** The cell is given variously in the literature as monoclinic or orthorhombic. A formal redefinition approved by the CNMMN would be helpful. **J.L.J.**

#### Redledgeite

J.A. Foley, J.M. Hughes, J.W. Drexler (1997) Redledgeite,  $\text{Ba}_x([\text{Cr,Fe,V}]_{2x}^{3+}\text{Ti}_{8-2x})\text{O}_{16}$ , the  $I4/m$  structure and elucidation of the sequence of tunnel Ba cations. *Can. Mineral.*, 35, 1531–1534.

Single-crystal X-ray structure study ( $R = 0.015$ ) of redledgeite of composition  $\text{Ba}_{1.10}(\text{Cr}_{0.88}\text{Fe}_{0.80}\text{V}_{0.08}\text{Ti}_{6.13})_{\Sigma 7.89}\text{O}_{16}$  from the type locality showed no superstructure reflections indicative of the previously determined monoclinic symmetry. The structure was refined in tetragonal symmetry, space group  $I4/m$ ,  $a = 10.1500(1)$ ,  $c = 2.9520(5)$  Å. **J.L.J.**

#### Shuangfengite

Zuxiang Yu (1998) Platinoshuangfengite, a new variety of shuangfengite. *Acta Mineral Sinica*, 18(1), 12–16 (in Chinese, English abs.).

The five electron microprobe analyses listed have Pt contents from 15.9 to 19.7 wt%, with a mean of 17.2 wt%, corresponding to Pt-rich shuangfengite  $(\text{Ir}_{0.57}\text{Pt}_{0.40}\text{Cu}_{0.01})_{\Sigma 0.98}(\text{Te}_{2.01}\text{Bi}_{0.01})_{\Sigma 2.01}$ . **J.L.J.**