

## NEW MINERAL NAMES\*

JOHN L. JAMBOR

CANMET, 555 Booth Street, Ottawa, Ontario K1A 0G1, Canada

ERNST A. J. BURKE

Instituut voor Aardwetenschappen, Vrije Universiteit, De Boelelaan 1085, 1081 HV, Amsterdam, The Netherlands

### Cannonite\*

C.J. Stanley, A.C. Roberts, D.C. Harris, A.J. Criddle, J.T. Szymański (1992) Cannonite,  $\text{Bi}_2\text{O}(\text{OH})_2\text{SO}_4$ , a new mineral from Marysvale, Utah, USA. *Mineral. Mag.*, 56, 605–609.

The average and (range) of ten electron microprobe analyses gave Bi 74.03 (72.87–75.01), S 5.68 (5.55–5.81),  $\text{H}_2\text{O}$  (by difference) 3.32,  $O_{\text{calc}}$  (for seven O atoms) 16.97, sum 100 wt%, corresponding to  $\text{Bi}_2\text{O}(\text{OH})_2\text{SO}_4$  by analogy with the structurally defined synthetic analogue. Occurs as crystal aggregates (<1 mm) of subhedral to euhedral, equant to prismatic crystals (<200  $\mu\text{m}$ ) or as irregular intergrown aggregates. Colorless, transparent, white streak, adamantine luster, brittle, uneven to conchoidal fracture, no cleavage, nonfluorescent,  $VHN_{100} = 229$  (183–280),  $H = 4$ ,  $D_{\text{calc}} = 6.515$ , with  $Z = 4$ . In reflected light, weakly to moderately birefractant in gray, weakly anisotropic, colorless to white internal reflection; reflectance percentages in air and in oil are, for  $R_1$  and  $R_2$ , 470 nm 10.8, 12.2 (1.86, 2.59), 546 nm 10.4, 11.7 (1.71, 2.35), 589 nm 10.4, 11.7 (1.71, 2.35), 650 nm 10.2, 11.5 (1.67, 2.26),  $Y\%$  10.4, 11.7,  $\lambda_d = 475, 475$ ,  $P_e\%$  2.6, 3.0 (illuminant C). Single-crystal X-ray study gave monoclinic symmetry, space group  $P2_1/c$ ,  $a = 7.700(3)$ ,  $b = 13.839(6)$ ,  $c = 5.686(2)$  Å,  $\beta = 109.11(3)^\circ$ , as refined from the powder pattern (114-mm Debye-Scherrer,  $\text{CuK}\alpha$  radiation) with strongest lines of 3.644(60,111), 3.466(60,040), 3.206(100,221), 2.924(70,131), and 2.782(50,112).

The mineral occurs in quartz gangue in a specimen from the Tunnel Extension mine, Marysvale, Utah, where it formed as an alteration product of Cu-Bi-Au-S ore. The name is for Benjamin Bartlett Cannon (1950– ) who first recognized the mineral. Type specimens are in the Natural History Museum, Great Britain, and in the National Mineral Collection, Ottawa, Canada. J.L.J.

### Coquandite\*

C. Sabelli, P. Orlandi, G. Vezzalini (1992) Coquandite,  $\text{Sb}_6\text{O}_8(\text{SO}_4) \cdot \text{H}_2\text{O}$ , a new mineral from Pereta, Tuscany, Italy, and two other localities. *Mineral. Mag.*, 56, 599–603.

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

The mineral occurs as white powdery masses and thin crusts with stibnite, as spheroidal knobs of feathery aggregates of silky fibers, as flexible lamellar crystals at the former Pereta stibnite mine, Tuscany, Italy, as minute tabular crystals associated with stibnite ore at Cetine, Tuscany, Italy, and as silky fibers and platelets on stibnite and stibiconite in a specimen from the Lucky Knock mine, Tonasket, Okanogan County, Washington. The average of electron microprobe (all three localities) and CHN analyses (Lucky Knock only) gave  $\text{Sb}_2\text{O}_3$  88.91,  $\text{SO}_3$  8.35,  $\text{CaO}$  0.04,  $\text{Na}_2\text{O}$  0.03,  $\text{H}_2\text{O}$  1.43, sum 98.76 wt%, corresponding to  $\text{Sb}_{5.98}\text{O}_8(\text{SO}_4)_{1.02}\text{Ca}_{0.01}\text{Na}_{0.01}\text{H}_{1.56}\text{O}_{0.74}$ , ideally  $\text{Sb}_6\text{O}_8(\text{SO}_4) \cdot \text{H}_2\text{O}$ . Occurs (Pereta) as transparent to translucent colorless crystals elongate [001], flattened (010) to a maximum thickness of 0.01 mm, showing {010} and minor {001}, {2 $\bar{1}$ 0}, and (1, $\bar{1}$ ,2,0); white streak, adamantine luster, onion-skin texture, common, nonfluorescent, no cleavage,  $D_{\text{calc}} = 5.78$  g/cm<sup>3</sup>, with  $Z = 12$ . Optically biaxial positive, mean  $n = 2.08(5)$ ,  $2V_{\text{meas}} = \gg 60^\circ$ , length slow, nonpleochroic, axial plane parallel to [001], parallel extinction on {010}, polysynthetically twinned on (010) twin plane. Single-crystal X-ray study indicated triclinic symmetry, probable space group  $P\bar{1}$  from partial structure analysis ( $R = 0.13$ ),  $a = 11.434(7)$ ,  $b = 29.77(4)$ ,  $c = 11.314(4)$  Å,  $\alpha = 91.07$ ,  $\beta = 119.24(3)$ ,  $\gamma = 92.82(1)^\circ$ . Strongest lines of the powder pattern (114-mm Gandolfi,  $\text{FeK}\alpha$  radiation) are 14.84(50,020), 9.27(41,11 $\bar{1}$ ,110), 6.81(67,130), 3.304(93,090), 3.200(39,323,320), and 3.092(100,330).

The new name is for French scientist Henri Coquand (1811–1881), who extensively studied the Sb deposits of Tuscany. Type material (Pereta) is in the Smithsonian Institution, Washington, DC, and in both the Museum of Natural History of the University of Florence and the Museum of Natural History of the University of Pisa, Italy. J.L.J.

### Edenharterite\*, ernigglite\*, stalderite\*

S. Graeser (1988) Three new mineral species from the Binntal. *Uni Nova*, 49, 17–19 (in German).

M. Weibel, S. Graeser, W.F. Oberholzer, H.-A. Stalder, W. Gabriel (1990) *Minerals of Switzerland* (5th edition) 222 p. Birkhäuser Verlag, Basel (in German).

P. Hottinger (1990) *Swiss mineral names*. Schweizer Strahler, 8, 349–362 (in German).

R. Cannon (1991) The Lengenbach quarry in Wallis, Switzerland. *Mineralien-Welt*, 2, 17–27 (in German).

- P. Hottinger (1991) Minerals named in honor of Swiss personalities. *Schweizer Strahler*, 9, 125–126 and 162–170 (in French).
- W. Metz (1991) The minerals of the Lengenbach quarry. *Mineralien-Welt*, 2, 28–45 (in German).
- S. Graeser, H. Schwander (1992) Edenharterite (TlPbAs<sub>3</sub>S<sub>6</sub>): A new mineral from Lengenbach, Binntal (Switzerland). *Eur. J. Mineral.*, 4, 1265–1270.
- S. Graeser, H. Schwander, R. Wulf, A. Edenharter (1992) Erniggliite (Tl<sub>2</sub>SnAs<sub>2</sub>S<sub>6</sub>), a new mineral from Lengenbach, Binntal (Switzerland): Description and crystal structure determination based on data from synchrotron radiation. *Schweiz. Mineral. Petrogr. Mitt.*, 72, 293–305.

The three thallium arsenic sulfosalts occur in dolomite in the higher level of a new quarry at Lengenbach (Binntal, Switzerland), where they are always closely associated with As-rich minerals (realgar, orpiment) and with various other thallium sulfosalts (hutchinsonite, hatchite, wallisite, lorandite, and Tl-bearing sartorite). Edenharterite is a rather common mineral in this assemblage, and stalderite and erniggliite are very rare.

#### Edenharterite

Electron microprobe analysis (mean of 3) gave Tl 25.51, Pb 25.08, Sn 0.06, As 27.09, S 23.17, sum 100.97 wt%, corresponding to (based on 11 atoms) Tl<sub>1.03</sub>Pb<sub>1.00</sub>As<sub>2.99</sub>S<sub>5.98</sub>, ideally TlPbAs<sub>3</sub>S<sub>6</sub>. Occurs in multiple parallel intergrowths (up to 2 mm in diameter) of isometric crystals (about 0.1–0.2 mm) slightly elongate along c. Brown-black to black color, translucent dark red in thin fragments, characteristic raspberry red streak,  $H = 2\frac{1}{2}$ –3,  $VHN_{10} = 98$  (95–101), uneven fracture, {100} cleavage,  $D_{\text{calc}} = 5.09$  g/cm<sup>3</sup>, with  $Z = 16$ . In reflected light, grayish white with a particular blue tint, very weak anisotropy, with characteristic bright red internal reflections. Reflectance values in air (WTiC standard) are 480 nm 28.5–30.5%, 546 28.5–31.5, 589 27.0–28.5, 656 27.0–29.0. X-ray single-crystal studies showed the mineral to be orthorhombic, space group *Fdd2*,  $a = 15.465(3)$ ,  $b = 47.507(8)$ ,  $c = 5.843(2)$  Å. Strongest powder diffraction lines (33 given) are 3.801(100,191), 3.755(15,331), 3.389(22,1.11.1), 2.901(19,3.11.1), 2.767(43,4.12.0), 2.732(41,511), 2.656(24,3.13.1), and 1.7915(15,8.10.0).

The name is for Dr. Andreas Edenharter (University of Göttingen, Germany), who synthesized TlPbAs<sub>3</sub>S<sub>6</sub> in 1982. Location of the type specimen is not stated (presumably the Natural History Museum in Basel).

#### Erniggliite

Electron microprobe analyses (mean of 3) gave Tl 47.91, Sn 13.55, As 17.01, S 22.20, sum 100.67 wt%, corresponding to (based on 11 atoms) Tl<sub>2.03</sub>Sn<sub>0.99</sub>As<sub>1.97</sub>S<sub>6.01</sub>, ideally Tl<sub>2</sub>SnAs<sub>2</sub>S<sub>6</sub>, the first Tl-Sn mineral described. Occurs as rough-surfaced, euhedral, short (<1 mm) prismatic hexagonal crystals showing {0001}, {10 $\bar{1}$ 0}, {10 $\bar{1}$ 1}, and {01 $\bar{1}$ 1}. Steel gray to black-gray color, shiny black on fresh cleavage planes, opaque even in thin lamellae, red-

dish black streak,  $H = 2$ –3,  $VHN_{10} = 47.7$  (46–49), micaceous {0001} cleavage, flexible cleavage lamellae,  $D_{\text{calc}} = 5.24$  g/cm<sup>3</sup>, with  $Z = 1$ . In reflected light (only sections parallel to {0001} could be studied), grayish white without bireflectance or pleochroism, isotropic, no internal reflection. Reflectance values in air (WTiC standard) 470 nm 28.6%, 543 27.3, 587 26.9, 657 25.1. X-ray single-crystal studies showed the mineral to be trigonal, space group *P $\bar{3}$* ,  $a = 6.680(3)$ ,  $c = 7.164(9)$  Å. Strongest powder diffraction lines (19 given) are 4.50(40,011), 3.343-(100,110), 3.060(50,102), 3.029(63,111), 2.679(48,201), 2.250(37,202), 1.930(36,030), and 1.866(38,212).

The name is for Ernst Niggli, professor emeritus in mineralogy and petrography at the University of Bern and president for many years of the Lengenbach Working Group. Location of type specimen material is not stated but is presumed to be the Natural History Museum in Basel.

#### Stalderite

Ideal formula (Tl,Cu)(Zn,Fe,Hg)AsS<sub>3</sub>, isotypic with routhierite (TlHgAsS<sub>3</sub>). The mineral occurs as small (<1 mm) tetragonal crystals, prismatic with dominant {110} and {100} faces, and smaller {101} and {211}. Typical bluish gray tarnish. The name is for Hans-Anton Stalder, former curator of the Natural History Museum in Bern and professor of mineralogy in Bern, and secretary of the Lengenbach Working Group. Type specimens are at the Natural History Museum and at the Institute of Mineralogy, both in Basel. A full description is in preparation.

**Discussion.** The three minerals and their names were approved by the IMA Commission on New Minerals and Mineral Names in August 1987. According to the procedures of this commission (Nickel and Mandarino, *Am. Mineral.*, 72, 1031–1042, 1987), approved minerals should be published within two years. Postponement of publication invites unofficial reference to incompletely described new minerals, a practice that is evident here and that should be regretted. **E.A.J.B.**

#### Fontanite\*

M. Deliens, P. Piret (1992) Fontanite, a uranyl and calcium hydrated carbonate, a new mineral species from Rabejac, Hérault, France. *Eur. J. Mineral.*, 4, 1271–1274 (in French, English abstract).

Electron microprobe and CHN analyses (H<sub>2</sub>O by difference) gave CaO 4.15, UO<sub>3</sub> 76.14, CO<sub>2</sub> 14.80, H<sub>2</sub>O 4.91, sum 100 wt%, corresponding to Ca<sub>0.85</sub>(UO<sub>2</sub>)<sub>3.08</sub>(CO<sub>3</sub>)<sub>3.89</sub>·3.15H<sub>2</sub>O, ideally Ca(UO<sub>2</sub>)<sub>3</sub>(CO<sub>3</sub>)<sub>4</sub>·3H<sub>2</sub>O. Occurs as bright yellow radiating aggregates (to 4 mm diameter) of rectangular lath-shaped crystals, elongate [001], platy (010), showing {100} and {010}; crystals are up to 1.2 × 0.15 × 0.05 mm. Vitreous luster, transparent, white streak,  $H = 3$ , cleavages {010}, {001}, and {100}; light green fluorescence under long-wave ultraviolet light,  $D_{\text{meas}} = >4.10$ ,  $D_{\text{calc}} = 4.19$  g/cm<sup>3</sup> with  $Z = 4$ . Optically biaxial negative,

$\alpha_{\text{calc}} = 1.603$ ,  $\beta = 1.690(2)$ ,  $\gamma = 1.710(3)$ ,  $2V_{\text{meas}} = 49(2)^\circ$ , nonpleochroic, weak dispersion  $r > v$ ,  $X = b$ ,  $Y = a$ ,  $Z = c$ . X-ray single-crystal study indicated orthorhombic symmetry, space group  $P2_1nm$ ,  $a = 15.337(3)$ ,  $b = 17.051(3)$ ,  $c = 6.931(2)$  Å. Strongest lines of the powder pattern (114-mm Debye-Scherrer,  $\text{CuK}\alpha$  radiation) are 8.55(100,020), 6.94(50,210), 4.11(60,301), 3.723(60,321), 3.460(50,002), 3.211(40,022), and 2.772(70,511).

The mineral occurs with billietite and uranophane in the oxidized zone of the Rabejac uranium deposit, 7 km south-southeast of Lodève, Hérault, France, in which the primary minerals are pitchblende, uraniferous carbon, and coffinite. The new name is for Dr. François Fontan, mineralogist at the University of Paul-Sabatier, Toulouse, France. Type material is in the Institut royal des Sciences naturelles de Belgique, Brussels, Belgium. J.L.J.

#### Mummeite\*

S. Karup-Møeller, E. Mackovicky (1992) Mummeite—A new member of the pavonite homologous series from Alaska mine, Colorado. *Neues Jahrb. Mineral. Mon.*, 555–576.

The mineral occurs as a gray aggregate of randomly intergrown, short columnar crystals ( $>1$  mm) among quartz crystals and with interstices filled by chalcopyrite. The columnar crystals exsolved into alternating lamellae that are oblique to crystal elongation; one set of lamellae consists of mummeite and the other of cuproplumbian mummeite, the latter etched more readily by  $\text{HNO}_3$ . For the composite intergrowth,  $VHN_{50} = 203(17)$ ,  $D_{\text{calc}} = 6.79$  (mummeite) and  $6.80$  g/cm<sup>3</sup> (cuproplumbian mummeite), with  $Z = 2$ . In reflected light, light gray relative to chalcopyrite, barely perceptible birefractance that is more conspicuous in oil, pronounced anisotropism in shades of gray, oblique extinction;  $R_{\text{max}}$  and  $R_{\text{min}}$  reflectances for the intergrowths are (470 nm) 47.5, 43.3, (546) 47.0, 42.8, (589) 46.4, 42.5, and (650) 45.7, 42.2. Representative electron microprobe analyses for mummeite and coexisting cuproplumbian mummeite gave, respectively, Ag 11.69, 10.81, Cu 2.22, 4.32, Pb 12.10, 14.40, Bi 56.04, 52.34, S 17.30, 16.99, sum 99.35, 99.84 wt%, corresponding to  $\text{Ag}_{2.61}\text{Cu}_{0.84}\text{Pb}_{1.41}\text{Bi}_{6.46}\text{S}_{13}$  and  $\text{Ag}_{2.46}\text{Cu}_{1.67}\text{Pb}_{1.71}\text{Bi}_{6.14}\text{S}_{13}$ , ideally  $M_{11}\text{S}_{13}$  with  $n\text{Cu}$  for Bi, Cu for Ag, and  $2\text{Pb}$  for Ag + Bi substitutions. Single-crystal X-ray study of mummeite gave monoclinic symmetry, space group  $C2/m$  or  $Cm$ ,  $a = 13.47(1)$ ,  $b = 4.06(1)$ ,  $c = 21.63(1)$  Å,  $\beta = 92.9(1)^\circ$ ; for cuproplumbian mummeite  $a = 13.48(1)$ ,  $b = 4.06(1)$ ,  $c = 21.72(1)$  Å,  $\beta = 93.9(1)^\circ$ . Strongest lines for a Gandolfi powder pattern of the intergrowth are 3.53(50,205), 3.43(50,113), 2.863(100,312), 2.023(100,515,604,119), and 1.652(40,4.0.11,227,803).

The new mineral, which represents the pavonite homologue  $N = 8$ , occurs at the Alaska mine, Ouray County, Colorado, with quartz, chalcopyrite, sphalerite, pyrite, ourayite,  $\text{AgBiS}_2$ - $\text{PbS}$  solid solution, heyrovskyite, and a

disordered pavonite homologue with  $N$  about 11. The new name is for W. G. Mumme, CSIRO, Melbourne, Australia. Type material is in the Denver Museum of Natural History, Denver, Colorado, and in the Geological Museum, Copenhagen, Denmark.

**Discussion.** The new mineral was also described by Mumme for material from the Mike mine, San Juan County, Colorado (*Am. Mineral.*, 76, 669–670, 1991). J.L.J.

#### Weinebeneite\*

F. Walter, W. Postl, J. Taucher (1990) *Weinebeneite: Paragenesis and morphology of a new Ca-Be phosphate from a spodumene pegmatite deposit at Weinebene, Koralpe, Carinthia.* *Mitt. Abt. Mineral. Landesmuseum Joanneum*, 58, 37–43 (in German, English abstract).

F. Walter (1992) *Weinebeneite,  $\text{CaBe}_3(\text{PO}_4)_2(\text{OH})_2 \cdot 4\text{H}_2\text{O}$ , a new mineral species: Mineral data and crystal structure.* *Eur. J. Mineral.*, 4, 1275–1283.

Combined results of electron microprobe, atomic absorption, electron energy loss spectroscopy, and loss on ignition analyses gave BeO 21.1, CaO 15.5,  $\text{P}_2\text{O}_5$  39.2,  $\text{H}_2\text{O}$  25.5, sum 101.3 wt%, which (based on O = 14) correspond to  $\text{Ca}_{0.99}\text{Be}_{3.02}\text{P}_{1.97}\text{O}_{7.88}(\text{OH})_{2.11} \cdot 4\text{H}_2\text{O}$ , ideally  $\text{CaBe}_3(\text{PO}_4)_2(\text{OH})_2 \cdot 4\text{H}_2\text{O}$ . The weinebeneite formula is identical with the original formula for uralolite (Grigor'ev, 1964, *Zapiski Vses. Mineral. Obshch.*, 93, 156–162), but Dunn and Gaines (*Mineral. Record*, 9, 99–100, 1978) obtained  $\text{Ca}_2\text{Be}_4(\text{PO}_4)_3(\text{OH})_3 \cdot 5\text{H}_2\text{O}$  as the formula, which was confirmed on uralolite from the Weinebene pegmatite.

The mineral occurs as transparent to translucent, colorless, platy crystals up to  $0.1 \times 0.3 \times 0.5$  mm, also as xenomorphic rosettes up to 20 mm in diameter. White streak, vitreous luster,  $H = 3$ –4, brittle with a splintery fracture, no cleavage, nonfluorescent. Most crystals are platy on {001} and elongate [100]; dominant forms (point group  $m$ ) are {001}, {00 $\bar{1}$ }, {110}, { $\bar{1}$ 10}, and {010}; rare forms are {100}, { $\bar{1}$ 00}, {111}, { $\bar{1}$ 11}, {113}, and { $\bar{1}$ 13}. No twinning.  $D_{\text{meas}} = 2.15(4)$ ,  $D_{\text{calc}} = 2.17$  g/cm<sup>3</sup>, with  $Z = 4$ . Optically biaxial positive,  $\alpha = 1.520(1)$ ,  $\beta = 1.520(1)$ ,  $\gamma = 1.530(1)$ ,  $2V_{\text{meas}} < 10^\circ$ ,  $Z:c = 42^\circ$  in acute angle  $\beta$ , nonpleochroic. Single-crystal X-ray structure study ( $R = 0.043$ ) showed the mineral to be monoclinic, space group  $Cc$ ,  $a = 11.897(2)$ ,  $b = 9.707(1)$ ,  $c = 9.633(1)$  Å,  $\beta = 95.76(1)^\circ$ ,  $a:b:c$  (calc.) = 1.2256:1:0.9924,  $a:b:c$  (meas. with optical two-circle reflection goniometer) = 1.227:1:0.994. Strongest powder diffraction lines (56 given) are 5.92(60,200), 5.74(42,111), 4.85(44,020), 4.33(49,021), 3.421(70,221), 2.959(60,400), 2.945(45,131), and 2.5130(100,223). The Gladstone-Dale relationship indicates superior compatibility:  $1 - (K_p/K_c) = -0.012$ . Weinebeneite is a framework beryllophosphate (the first reported one with three-membered rings) with Ca and  $\text{H}_2\text{O}$  molecules in the cavities of the structure.

TABLE 1. Classification of the wodginite group

Name	End-member	A site	B site
Wodginite	Mn <sub>4</sub> Sn <sub>4</sub> Ta <sub>8</sub> O <sub>32</sub>		≤50% Ti ≤25% Fe <sup>3+</sup>
Titanowodginite	Mn <sub>4</sub> Ti <sub>4</sub> Ta <sub>8</sub> O <sub>32</sub>	≤50% Li ≤50% Fe <sup>2+</sup>	>50% Ti
Unnamed	Mn <sub>4</sub> (Fe <sub>2</sub> <sup>3+</sup> Ta <sub>2</sub> )Ta <sub>8</sub> O <sub>32</sub>		>25% Fe <sup>3+</sup> >25% Ta
Ferrowodginite	Fe <sub>4</sub> <sup>2+</sup> Sn <sub>4</sub> Ta <sub>8</sub> O <sub>32</sub>		≤50% Ti ≤25% Fe <sup>3+</sup>
Unnamed	Fe <sub>2</sub> <sup>3+</sup> Ti <sub>4</sub> Ta <sub>8</sub> O <sub>32</sub>	>50% Fe <sup>2+</sup>	>50% Ti
Unnamed	Fe <sub>2</sub> <sup>3+</sup> (Fe <sub>2</sub> <sup>3+</sup> Ta <sub>2</sub> )Ta <sub>8</sub> O <sub>32</sub>		>25% Fe <sup>3+</sup> (>25% Ta)
Lithiowodginite	Li <sub>4</sub> Ta <sub>4</sub> Ta <sub>8</sub> O <sub>32</sub>	>50% Li	>50% Ta

Weinebeneite occurs as a secondary mineral associated with fairfieldite, roscherite, and uralolite in small fractures in a spodumene pegmatite at Weinebene in the high-grade metamorphic rocks of the Koralpe, Carinthia, Austria. The name is for the locality. Type material is in the Landesmuseum Joanneum, Graz (Styria), in the Kärntner Landesmuseum, Klagenfurt (Carinthia), and in the Naturhistorisches Museum, Vienna.

**Discussion.** The mineral data should have been published before the paragenetic and morphological descriptions. **E.A.J.B.**

#### Wodginite group\*

T.S. Ercit, P. Černý, F.C. Hawthorne (1992) The wodginite group. III. Classification and new species. *Can. Mineral.*, 30, 633–638.

The minerals of the wodginite group are isostructural oxides (monoclinic, space group *C2/c*, *Z* = 4) with the general formula *ABC*<sub>2</sub>O<sub>8</sub>, where *A* = Mn<sup>2+</sup>, Fe<sup>2+</sup>, Li, □; *B* = Sn<sup>4+</sup>, Ti, Fe<sup>3+</sup>, Ta; *C* = Ta, Nb. The classification in Table 1 has been approved by the IMA.

Species names are to consist of the root “wodginite” modified by prefixes that reflect the A- and B-site compositions. The classification includes the approved new species names titanowodginite and ferrowodginite.

#### Titanowodginite

Electron microprobe analyses of a slightly zoned crystal gave, for the core and rim, respectively, MnO 9.0, 9.6, FeO 3.1, 2.5, Fe<sub>2</sub>O<sub>3</sub> 0.1, 0.5, TiO<sub>2</sub> 9.2, 8.0, SnO<sub>2</sub> 7.4, 8.3, Nb<sub>2</sub>O<sub>5</sub> 11.1, 11.1, Ta<sub>2</sub>O<sub>5</sub> 59.9, 60.3, sum 99.7, 100.3 wt%, the average corresponding to (Mn<sub>3.04</sub>Fe<sub>0.89</sub>□<sub>0.07</sub>)<sub>24</sub>(Ti<sub>2.49</sub>Sn<sub>1.21</sub>Ta<sub>0.22</sub>Fe<sub>0.08</sub><sup>3+</sup>)<sub>24</sub>(Ta<sub>6.06</sub>Nb<sub>1.94</sub>)<sub>28</sub>O<sub>32</sub>, ideally MnTiTa<sub>2</sub>O<sub>8</sub>. Occurs as dark brown to black euhedral, bipyramidal {111} single crystals to 1 cm long and as irregular clusters of crystals; some crystals also have prominent {101} and {100}. Transparent to translucent, dark brown streak, brittle, irregular fracture, *H* = 5½, nonfluorescent, *D*<sub>meas</sub> = 6.86, *D*<sub>calc</sub> = 6.89 g/cm<sup>3</sup>, with *Z* = 4; penetration twins are typical, with {001} and {100} as the composition planes. Optically anisotropic, biaxial positive, *n* = >2.0. Single-crystal X-ray study indicated monoclinic symmetry, space group *C2/c*, *a* = 9.466(2), *b* = 11.431(1), *c* = 5.126(1) Å, β = 90.31(2)°. Strongest lines of the powder

pattern (diffractometer, Cu radiation) are 3.644(46,220), 2.976(100,221), 2.966(95,221), 2.495(36,041), and 1.715-(23,441).

The mineral occurs with microlite and manganocolumbite in saccharoidal albite at the Tanco pegmatite, Bernic Lake, Manitoba. The new name alludes to the composition.

#### Ferrowodginite

Electron microprobe analysis gave FeO 9.3, MnO 2.8, Fe<sub>2</sub>O<sub>3</sub> 1.9, TiO<sub>2</sub> 4.3, SnO<sub>2</sub> 10.1, Nb<sub>2</sub>O<sub>5</sub> 14.8, Ta<sub>2</sub>O<sub>5</sub> 56.3, sum 99.4 wt%, corresponding to (Fe<sub>3.04</sub>Mn<sub>0.93</sub>□<sub>0.03</sub>)<sub>24</sub>(Sn<sub>1.58</sub>Ti<sub>1.27</sub>Fe<sub>0.53</sub>Ta<sub>0.60</sub>)<sub>24</sub>(Ta<sub>5.38</sub>Nb<sub>2.62</sub>)<sub>28</sub>O<sub>32</sub>, ideally Fe<sup>2+</sup>SnTa<sub>2</sub>O<sub>8</sub>. Occurs as dark brown to black, anhedral grains up to 0.3 mm. Dark brown streak, transparent to translucent, vitreous luster, brittle, irregular fracture, *H* = 5½, nonfluorescent, *D*<sub>calc</sub> = 7.02 g/cm<sup>3</sup> with *Z* = 4. Optically anisotropic, *n* = >2, polysynthetically twinned. Single-crystal X-ray study indicated monoclinic symmetry, space group *C2/c*, *a* = 9.415(7), *b* = 11.442(6), *c* = 5.103(4) Å, β = 90.8(1)°. Strongest lines of the powder pattern (114-mm Gandolfi, Cu radiation) are 4.16(50,111,111), 2.97(100,221,221), 2.55(30,002), 2.493(40,041), and 1.455(30,621,262). The mineral occurs with tapiolite and native bismuth as inclusions in granular aggregates of cassiterite from a granitic pegmatite near Sukula, southwestern Finland. The new name alludes to the composition.

**Discussion.** Type specimens of titanowodginite and ferrowodginite are in the Mineralogical Museum, University of Manitoba, Winnipeg, Manitoba (T. S. Ercit, personal communication, 1992). See also tantalowodginite (New Data). **J.L.J.**

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

A.E. Izokh, O.N. Mayorova, Yu.G. Lavrentiev (1992) Minerals of the platinum metals in the Nomgon troctolite-anorthosite-gabbro intrusive massif (Mongolia). *Russian Geol. Geophys.*, 33(1), 87–92.

Electron microprobe analyses of two grains gave Pd 68.66, 67.25, Pt 0.03, 0.09, Rh 0.01, 0.03, Ni–, 3.96, Sb 22.01, 22.19, As 9.08, 6.92, S not found, –, sum 99.79, 100.46 wt%, reported as Pd<sub>2</sub>(Sb,As). The mineral occurs as inclusions of unstated size in mertieite-II and as a cluster of crystals in bornite, also intergrown with isomertieite, sperrylite, and Pt minerals.

**Discussion.** The analyses correspond to Pd<sub>2.14</sub>-(Sb<sub>0.60</sub>As<sub>0.40</sub>) and Pd<sub>2.30</sub>Ni<sub>0.25</sub>(Sb<sub>0.66</sub>As<sub>0.34</sub>). The mineral Pd<sub>2</sub>(Sb,As) or Pd<sub>2</sub>(Sb,Sn) has now been reported from several localities, but never with a complete description (*Am. Mineral.*, 77, p. 1307, 1992). **J.L.J.**

#### New Data

##### Alumotantite

T.S. Ercit, F.C. Hawthorne, P. Černý (1992) The crystal structure of alumotantite: Its relation to the structure of simpsonite and the (Al,Ga)(Ta,Nb)O<sub>4</sub> compounds. *Can. Mineral.*, 30, 653–662.

Alumotantite,  $\text{AlTaO}_4$ , is orthorhombic, space group  $Pbcn$ ,  $a = 4.473(1)$ ,  $b = 11.308(4)$ ,  $c = 4.775(1)$  Å,  $D_{\text{calc}} = 7.47$  g/cm<sup>3</sup>, with  $Z = 4$ . Strongest lines of the X-ray powder pattern (114-mm Gandolfi, Cu radiation) are 3.64(50,021), 3.13(100,111), 2.88(60,130), 2.427(40,041), 1.834(40,132), and 1.644(40,241). The unit cell is new. **J.L.J.**

#### Betpakdalite

P.B. Moore (1992) Betpakdalite unmasked, and a comment on bond valences. *Austral. J. Chem.*, 45, 1335–1354.

Transformation of the previous cell of  $a = 19.44$ ,  $b = 11.096$ ,  $c = 15.25$  Å,  $\beta = 131.28^\circ$ , space group  $C12/m1$ , gives the new cell  $a = 11.10$ ,  $b = 19.44$ ,  $c = 22.93$  Å,  $\alpha = 91.70^\circ$ , space group  $F2/m11$ . The new formula for  $x = 2$  is  $\text{H}_8[\text{K}(\text{H}_2\text{O})_6]_4[\text{Ca}(\text{H}_2\text{O})_6]_8[\text{Mo}_{32}^{6+}\text{Fe}_{12}^{3+}\text{As}_8^{5+}\text{O}_{148}] \cdot 8\text{H}_2\text{O}$ ,  $D_{\text{calc}} = 2.90$  g/cm<sup>3</sup>. Only 46.25% of anion space is occupied by ordered  $\text{O}^{2-}$  anions, and the remainder of the space consists of ordered vacancies. **J.L.J.**

#### Cowlesite

G. Vezzalini, G. Artioli, S. Quartieri (1992) The crystal chemistry of cowlesite. *Mineral. Mag.*, 56, 575–579.

Indexing of powder diffractograms of cowlesite indicates that the orthorhombic cell has dimensions of  $a = 23.3$ ,  $b = 30.6$ ,  $c = 25.0$  Å. The TG-determined formula content of  $\text{H}_2\text{O}$  ranged from 30.22 to 32.77, as compared with the ideal formula,  $\text{Ca}_6\text{Al}_{12}\text{Si}_{18}\text{O}_{60} \cdot 36\text{H}_2\text{O}$ . **J.L.J.**

#### Lazurite

A.N. Sapozhnikov (1992) Modulated structure of lazurite from deposits in southwestern Pamir. *Soviet Phys. Crystallogr.*, 37(4), 470–472.

In addition to triclinic and monoclinic structures reported recently (*Am. Mineral.*, 76, p. 1734, 1991) for lazurite from the Baikal region, an optically anisotropic orthorhombic form, space group  $Pnaa$ ,  $a = 9.072$ ,  $b = 12.830$ ,  $c = 38.49$  Å, occurs in lazurite from southwestern Pamir. Strongest lines of the powder pattern are 6.43(30,020,006), 3.715(100,206,220), 2.871(40,046), 2.619(80,2.0.12,240), and 2.137(40,159,1.3.15). Characteristic features of the powder pattern are the presence of  $0kl$  reflections with odd  $k$  and  $l$  and the appearance of a line at 12.2 Å (5,011). **J.L.J.**

#### Taikanite

N.A. Yamnova, L.V. Kalacheva, D.Yu. Pushcharovskii, V.V. Kalinin (1992) Crystal structure of taikanite  $\text{Sr}_2\text{BaMn}_2[\text{Si}_4\text{O}_{12}]\text{O}_2$ . *Soviet Phys. Crystallogr.*, 37(3), 319–321.

Single-crystal X-ray structure study ( $R = 0.035$ ) of taikanite from the type locality gave monoclinic symmetry, space group  $C2$ ,  $a = 14.59(1)$ ,  $b = 7.769(9)$ ,  $c = 5.141(3)$  Å,  $\beta = 93.28(6)^\circ$ ,  $Z = 1$ . The structurally derived formula  $\text{Sr}_2\text{BaMn}_2[\text{Si}_4\text{O}_{12}]\text{O}_2$  and the cell are new. **J.L.J.**

#### Tantalowodginite

T.S. Ercit, P. Černý, F.C. Hawthorne (1992) The wodginite group. III. Classification and new species. *Can. Mineral.*, 30, 633–638.

The former species status of tantalowodginite is withdrawn because the type samples are recognized to be Tarich wodginite and lithiowodginite. Although one of the previously described analyses may have a composition appropriate for the name, the lack of determination of Li and the lack of X-ray characterization because of minute grain size indicate that it is not presently possible to use tantalowodginite as a species name. **J.L.J.**