

## NEW MINERAL NAMES\*

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### Briziite\*

F. Olmi, C. Sabelli (1994) Briziite,  $\text{NaSbO}_3$ , a new mineral from the Cetine mine (Tuscany, Italy): Description and crystal structure. *Eur. Jour. Mineral.*, 6, 667–672.

The mineral occurs as light pink to yellow, compact aggregates of platy to thin tabular crystals that encrust weathered waste material and slag at the Cetine antimony (stibnite) mine near Siena, Tuscany, Italy. Electron microprobe analysis gave  $\text{Na}_2\text{O}$  15.98,  $\text{Sb}_2\text{O}_3$  83.28 wt%, corresponding to  $\text{NaSbO}_3$ . Platy crystals are hexagonal in outline, up to 0.2 mm across, colorless, transparent, white streak, pearly luster, perfect {001} cleavage, flexible,  $VHN_{15} = 57$  (41–70), nonfluorescent, polysynthetically twinned on (100),  $D_{\text{meas}} = 4.8(2)$ ,  $D_{\text{calc}} = 4.95$  g/cm<sup>3</sup> for  $Z = 6$ . Optically uniaxial negative,  $\epsilon = 1.631(1)$ ,  $\omega = 1.84$  (calculated). Single-crystal X-ray structure study ( $R = 0.025$ ) indicated hexagonal symmetry, space group  $R\bar{3}$ ,  $a = 5.301(1)$ ,  $c = 15.932(4)$  Å as derived from a powder pattern (114-mm Gandolfi, Cu radiation) with strongest lines of 5.30(53,003), 3.00(50,104), 2.650(67,006,110), 2.365(69,113), 1.874(100,116), 1.471(69,119,303), and 1.185(47,1.0.13,226).

The new mineral, which is the rhombohedral dimorph (ilmenite structure) of  $\text{NaSbO}_3$ , is named for G. Brizzi (1936–1992), who collected the original specimens. Type material is in the Museum of Natural History of the University of Florence, Italy. J.L.J.

### Coniféite

G.C. Popescu (1990) Cobalt pentlandite and its new isomorph in the cupriferous pyritic mineralization at Baia de Aramă (south Carpathians). *Rev. Roum. Geol. Geophys. Geogr.; Geology*, 34, 11–12 (in French, English abs.).

Occurs with cobalt pentlandite as gray, isotropic grains whose relief and polishing character are similar to those of cobalt pentlandite, but with reflectance much lower. Qualitative electron microprobe analyses show a reduced

Co and increased Ni content in coniféite, the name alluding to the principal cations Co-Ni-Fe.

**Discussion.** An unapproved name for an incompletely described mineral. J.L.J.

### Grossite\*

D. Weber, A. Bischoff (1994) Grossite ( $\text{CaAl}_4\text{O}_7$ )—a rare phase in terrestrial rocks and meteorites. *Eur. Jour. Mineral.*, 6, 591–594.

D. Weber, A. Bischoff (1994) The occurrence of grossite ( $\text{CaAl}_4\text{O}_7$ ) in chondrites. *Geochim. Cosmochim. Acta*, 58, 3855–3877.

Electron microprobe analysis gave  $\text{CaO}$  21.4,  $\text{Al}_2\text{O}_3$  77.8,  $\text{FeO}$  0.31,  $\text{TiO}_2$  0.15,  $\text{SiO}_2$  0.11,  $\text{MgO}$  0.06, sum 99.83 wt%, corresponding to  $(\text{Ca}_{1.00}\text{Fe}_{0.01})_{21.01}\text{Al}_{3.99}\text{O}_{7.00}$ . Occurs in meteorites as white to colorless, transparent, polycrystalline aggregates (<400  $\mu\text{m}$ ) of anhedral grains and euhedral to subhedral prismatic crystals to <30  $\mu\text{m}$ ; also as laths and round grains to <30  $\mu\text{m}$  in argillaceous limestones. Synthetic material is optically biaxial positive,  $\alpha = 1.6178(3)$ ,  $\beta = 1.6184(3)$ ,  $\gamma = 1.6516(3)$ ,  $2V_{\text{meas}} = 12(1)$ ,  $2V_{\text{calc}} = 15.5^\circ$ . Strongest lines of the X-ray powder pattern (microdiffractometer, Cr radiation) are 4.460(43,020), 3.515(10,311), 2.605(36,131), 2.440(21,511), and 1.764 (20,313), from which the monoclinic cell, space group  $C2/c$ , is  $a = 12.94(1)$ ,  $b = 8.910(8)$ ,  $c = 5.446(4)$  Å,  $\beta = 107.0(1)^\circ$ , in good agreement with results for the synthetic analogue.  $D_{\text{calc}} = 2.88$  g/cm<sup>3</sup> for  $Z = 4$ .

The mineral formed by high-temperature metamorphism of argillaceous limestone and is associated with brownmillerite and mayenite. Also occurs as a rare mineral in several meteorites, but can be a major phase with in their Ca,Al-rich inclusions. The new name is for Shulamit Gross, emeritus member of the Geological Survey of Israel, who initially discovered the mineral in argillaceous limestone in Israel. Meteorites containing grossite are in the Museum für Naturkunde der Humboldt-Universität zu Berlin, Germany, and in the Institute für Planetologie, Münster, Germany. J.L.J.

### Mcalpineite\*

A.C. Roberts, T.S. Ercit, A.J. Criddle, G.C. Jones, R.S. Williams, F.F. Cureton II, M.C. Jensen (1994) Mcal-

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

pineite,  $\text{Cu}_3\text{TeO}_6 \cdot \text{H}_2\text{O}$ , a new mineral from the McAlpine mine, Tuolumne County, California, and from the Centennial Eureka mine, Juab County, Utah. *Mineral Mag.*, 58, 417–424.

The mineral occurs rarely as isolated, emerald-green, cryptocrystalline crusts to 0.5 mm on quartz from the McAlpine mine (type locality) and more commonly as olive-green coatings and millimeter-size dark green-black cryptocrystalline nodules lining drusy quartz vugs in oxidized boulders from the dump of the Centennial Eureka mine. The crusts and nodules consist of micrometer-size sheaves of fibrous or prismatic grains that form anhedral aggregates simulating crystals up to 20  $\mu\text{m}$ . Adamantine luster, light green streak, transparent to translucent, brittle, uneven fracture, nonfluorescent, hardness and density not determinable. Electron microprobe analysis (McAlpine mine) gave CuO 50.84, NiO 0.17, PbO 4.68,  $\text{SiO}_2$  0.65,  $\text{TeO}_3$  39.05,  $\text{H}_2\text{O}_{\text{calc}}$  4.51, sum 100 wt%, corresponding to  $(\text{Cu}_{2.79}\text{Pb}_{0.09}\text{Ni}_{0.01})_{22.89}(\text{Te}_{0.97}\text{Si}_{0.05})_{21.02}\text{O}_{5.90} \cdot 1.10\text{H}_2\text{O}$ , ideally  $\text{Cu}_3\text{TeO}_6 \cdot \text{H}_2\text{O}$ . The presence of  $\text{H}_2\text{O}$  was confirmed in the infrared spectrum and by analysis of the mineral from the Centennial Eureka mine. In reflected light, gray, isotropic, brilliant green internal reflection; reflectances are tabulated in 20-nm steps;  $n_{\text{calc}} = 2.01$ . Strongest lines of the X-ray powder pattern (114-mm Debye-Scherrer, Cu radiation) are 4.26(40,210), 2.763(100,222), 2.384(70,400), 1.873(40,431,510), 1.689(80,440), and 1.440(60,622) Å. The pattern is similar to that of synthetic  $\text{Cu}_3\text{TeO}_6$ , and was indexed on a cubic cell with  $a = 9.555(2)$  Å; for  $Z = 8$ ,  $D_{\text{calc}} = 6.65$  g/cm<sup>3</sup>. Type material is in the Natural History Museum, Great Britain, and in the National Mineral Collection, Ottawa, Canada. J.L.J.

#### Paraniite-(Y)\*

F. Demartin, C.M. Gramaccioli, T. Pilati (1994) Paraniite-(Y), a new tungstate arsenate mineral from Alpine fissures. *Schweiz. Mineral. Petrol. Mitt.*, 74, 155–160.

The mineral occurs in a single specimen as a few elongate, dipyrarnidal, tetragonal crystals up to 3 mm. Creamy yellow color, vitreous luster, distinct {001} cleavage, uneven to subconchoidal parting, moderately strong orange-yellow fluorescence in short-wave ultraviolet light (254 nm); nonfluorescent at 366 nm. Electron microprobe analysis gave CaO 12.35,  $\text{Y}_2\text{O}_3$  16.15,  $\text{Gd}_2\text{O}_3$  0.70,  $\text{Dy}_2\text{O}_3$  1.87,  $\text{Er}_2\text{O}_3$  1.37,  $\text{Yb}_2\text{O}_3$  0.81,  $\text{UO}_2$  0.25,  $\text{WO}_3$  51.61,  $\text{As}_2\text{O}_3$  16.92, sum 102.03 wt%; combined with the single-crystal X-ray structure determination ( $R = 0.024$ ) the formula is  $[\text{Ca}_{1.64}(\text{Y},\text{REE})_{0.36}]_{22.00}(\text{Y},\text{REE})[(\text{As}_{0.96} - \text{W}_{0.04})_{21.00}\text{O}_4][(\text{W}_{0.89}\text{As}_{0.11})_{21.00}\text{O}_4]_2$ , ideally  $\text{Ca}_2(\text{Y},\text{REE})(\text{AsO}_4)(\text{WO}_4)_2$ . Optically uniaxial positive,  $\omega = 1.87(1)$ ,  $\epsilon = 1.92(1)$ . Tetragonal symmetry, space group  $I4_1/a$ ,  $a = 5.135(1)$ ,  $c = 33.882(5)$  Å,  $D_{\text{calc}} = 5.95$  g/cm<sup>3</sup> for  $Z = 4$ . Strongest lines of the calculated powder pattern are 4.674(16,013), 3.054(100,116), 2.567(19,020), 1.899-(32,0.2.12), 1.816(16,220), 1.671(17,1.1.18), and 1.560-(32,136). The structure is of the scheelite type.

The new name is for the discoverer, mineral collector F. Parani. The mineral occurs in a fissure in gneiss from Pizzo Cervandone, on the Italian side of the Swiss-Italy border. Type material is in the Museum of the Centro Studi "P. Ginocchi" at Crodo, Ossola Valley, Italy.

**Discussion.** A preliminary report of the crystal structure and the name *paranite-(Y)* was abstracted in *Am. Mineral.*, 78, p. 452, 1993. J.L.J.

#### Quadridavyne\*

E. Bonaccorsi, S. Merlino, P. Orlandi, M. Pasero, G. Vezzaline (1994) Quadridavyne,  $[(\text{Na},\text{K})_6\text{Cl}_2][\text{Ca}_2\text{Cl}_2][\text{Si}_6\text{Al}_6\text{O}_{24}]$ , a new feldspathoid mineral from Vesuvius area. *Eur. Jour. Mineral.*, 6, 481–487.

The mineral occurs as colorless, transparent, prismatic crystals, elongate [001] to 2 mm, hexagonal in outline and up to 0.5 mm across, in two ash samples derived from the 1906 eruption of Mount Vesuvius. Electron microprobe analysis gave  $\text{SiO}_2$  33.09,  $\text{Al}_2\text{O}_3$  27.62, CaO 11.35,  $\text{Na}_2\text{O}$  11.21,  $\text{K}_2\text{O}$  5.93,  $\text{SO}_3$  1.08, Cl 12.13,  $\text{O} \equiv \text{Cl}$  2.74, sum 99.67 wt%, corresponding to  $\text{Na}_{3.97}\text{K}_{1.38}\text{Ca}_{2.22}\text{Al}_{5.95}\text{Si}_{6.05}\text{O}_{23.90}(\text{SO}_4)_{0.15}\text{Cl}_{3.76}$ , with the ideal formula as given above. Vitreous luster, white streak,  $H = 5$ , brittle, nonfluorescent, perfect {001} and distinct {110} cleavages,  $D_{\text{meas}} = 2.335(5)$ ,  $D_{\text{calc}} = 2.354$  g/cm<sup>3</sup> for  $Z = 4$ . Dominant forms are {0001} and {10 $\bar{1}$ 0}; commonly twinned ( $\bar{1}\bar{1}$ 00). Optically uniaxial positive,  $\omega = 1.529(1)$ ,  $\epsilon = 1.532(1)$ . Preliminary single-crystal X-ray structure study ( $R = 0.14$ ) indicated hexagonal symmetry, space group  $P6_3/m$ ,  $a = 25.771(6)$ ,  $c = 5.371(1)$  Å as refined from a Gandolfi powder pattern (Fe radiation) with strongest lines of 4.85(s,201), 3.71(vs,600), 3.31(vs,421), and 2.788(s,800). The mineral is distinguishable from davyne only with the help of long-exposure, single-crystal X-ray data, which show the doubling of  $a$  relative to that of davyne.

The mineral was found in museum specimens of ash that fell at Ottaviano, near Napoli, southern Italy. The new name alludes to the quadrupling of the unit-cell volume relative to that of davyne. Type material is in the Museo di Storia Naturale e del Territorio, University of Pisa, Italy. J.L.J.

#### Sazykinaite-(Y)\*

A.P. Khomyakov, G.N. Nechelustov, R.K. Rastsvetaeva (1993) Sazykinaite-(Y)  $\text{Na}_3\text{YZrSi}_6\text{O}_{18} \cdot 6\text{H}_2\text{O}$ —a new mineral. *Zapiski Vseros. Mineral. Obshch.*, 122(5), 76–82 (in Russian).

Electron microprobe analyses (mean of five,  $\text{H}_2\text{O}$  by DTA) gave  $\text{Na}_2\text{O}$  15.18,  $\text{K}_2\text{O}$  3.05,  $\text{Y}_2\text{O}_3$  8.74,  $\text{Ce}_2\text{O}_3$  0.17,  $\text{Nd}_2\text{O}_3$  0.25,  $\text{Sm}_2\text{O}_3$  0.38,  $\text{Eu}_2\text{O}_3$  0.24,  $\text{Gd}_2\text{O}_3$  1.03,  $\text{Tb}_2\text{O}_3$  0.21,  $\text{Dy}_2\text{O}_3$  1.26,  $\text{Er}_2\text{O}_3$  0.79,  $\text{Tm}_2\text{O}_3$  0.16,  $\text{Yb}_2\text{O}_3$  0.74,  $\text{ThO}_2$  0.60,  $\text{ZrO}_2$  10.24,  $\text{TiO}_2$  1.36,  $\text{SiO}_2$  40.51,  $\text{Nb}_2\text{O}_5$  1.30,  $\text{H}_2\text{O}$  12.6, sum 98.81 wt%, which for 18 O corresponds to  $(\text{Na}_{4.38}\text{K}_{0.579})_{24.959}(\text{Y}_{0.692}\text{Dy}_{0.061}\text{Gd}_{0.051}\text{Er}_{0.037}\text{Yb}_{0.027}\text{Th}_{0.025}\text{Sm}_{0.020}\text{Nd}_{0.013}\text{Eu}_{0.012}\text{Tb}_{0.011}\text{Ce}_{0.009}\text{Tm}_{0.007})_{20.965}$

(Zr<sub>0.743</sub>Ti<sub>0.152</sub>Nb<sub>0.088</sub>)<sub>Σ0.983</sub>Si<sub>6.028</sub>O<sub>18.00</sub>·6.25H<sub>2</sub>O, ideally Na<sub>3</sub>YZrSi<sub>6</sub>O<sub>18</sub>·6H<sub>2</sub>O. Solid solution of Y<sup>3+</sup> + Na<sup>+</sup> = Zr<sup>4+</sup> is assumed. Occurs typically as rhombohedral crystals (up to 0.5–2 mm across) and as complex grains showing {011̄2}. Transparent, vitreous luster, light green to yellow color, white streak, imperfect cleavage {011̄2}, fragile,  $H = 5$ ,  $D_{\text{meas}} = 2.67(5)$ ,  $D_{\text{calc}} = 2.74 \text{ g/cm}^3$  for  $Z = 3$ . Optically uniaxial negative,  $\epsilon = 1.578(2)$ ,  $\omega = 1.585(2)$ . Single-crystal X-ray structure study ( $R = 0.034$ ) indicated trigonal symmetry, space group  $R\bar{3}2$ ,  $a = 10.825(5)$ ,  $c = 15.809(4)$  Å as refined from the powder pattern (diffractometer,  $\text{CuK}\alpha$  radiation). Strongest lines (43 given) are 6.03(32,012), 5.40(63,110), 3.236(84,122), 3.127(88,300), 3.030(100,024), 2.708(19,220), 2.018(18,404), and 1.805(21,330).

The mineral occurs in pegmatites of the Koashva Mountain (Khibiny alkaline massif), Kola Peninsula, Russia, where it forms intergrowths with labuntsovite and is associated with aegirine, natrolite, alkali feldspars, pectolite, alkali amphibole, astrophyllite, lomonosovite, and sphalerite. The name is for L.B. Sazykina, a well-known mineralogist and artist (painter) from the Kola Peninsula. Type material is at the Fersman Mineralogical Museum, Moscow, and the Museum of the Gorny Institute, Saint Petersburg, Russia. The mineral is the Y-dominant analogue of hilairite and calciophilairite. V.A.K.

#### **Pb<sub>2</sub>Bi<sub>2</sub>(S,Se)<sub>3</sub>, (Bi,Pb)<sub>3</sub>(S,Se)<sub>4</sub>**

M.S. Sakharova, I.A. Bryzgalov, S.K. Ryakhovskaya (1993) Mineralogy of selenides in deposits in volcanic belts. Zapiski Vseros. Mineral. Obshch., 122(3), 1–9 (in Russian, English abs.).

#### **Pb<sub>2</sub>Bi<sub>2</sub>(S,Se)<sub>3</sub>**

Five electron microprobe analyses gave highly variable compositions of (average and range, respectively) Pb 41.55 (36.10–45.97), Ag 0.19 (0.00–0.42), Bi 39.85 (34.27–46.42), Sb 0.009 (0.00–0.17), As 0.14 (0.00–0.51), Se 10.82 (10.48–11.37), S 6.01 (5.44–7.86), sum 98.57 (96.49–101.25) wt%, corresponding to Pb<sub>1.949</sub>Ag<sub>0.017</sub>Bi<sub>1.853</sub>Sb<sub>0.07</sub>As<sub>0.018</sub>Se<sub>1.332</sub>S<sub>1.823</sub>, ideally Pb<sub>2</sub>Bi<sub>2</sub>(S,Se)<sub>3</sub>. Trigonal symmetry is assumed. The mineral and (Bi,Pb)<sub>3</sub>(S,Se)<sub>4</sub> (see below) are associated with sulfoselenides and seleniferous sulfosalts which occur at the Nevsky tin deposit, northeastern Russia.

#### **(Bi,Pb)<sub>3</sub>(S,Se)<sub>4</sub>**

Electron microprobe analyses (mean of three) gave Pb 34.84, Ag 0.29, Bi 41.18, Sb 0.16, As 0.19, Se 9.42, S 12.03, sum 98.82 wt%, corresponding to Pb<sub>1.353</sub>Ag<sub>0.021</sub>Bi<sub>1.580</sub>Sb<sub>0.040</sub>As<sub>0.020</sub>Se<sub>0.960</sub>S<sub>3.019</sub>, ideally (Bi,Pb)<sub>3</sub>(S,Se)<sub>4</sub>.

**Discussion.** The formula for Pb<sub>2</sub>Bi<sub>2</sub>(S,Se)<sub>3</sub> is unbalanced in terms of charge neutrality. The ideal formula for (Bi,Pb)<sub>3</sub>(S,Se)<sub>4</sub> may be considered also as Pb(Bi,Pb)<sub>2</sub>(S,Se)<sub>4</sub>, which may be the same mineral as Pb<sub>4</sub>Bi<sub>5</sub>S<sub>12</sub> (*Am. Mineral.*, 70, 879–880, 1985, and *Am. Mineral.*, 68, 1041, 1983). X-ray data are needed. V.A.K.

#### **Cu<sub>20</sub>(Fe,Zn,Cu)<sub>6</sub>Mo<sub>2</sub>Ge<sub>6</sub>S<sub>32</sub>, Cu<sub>20</sub>(Fe,Cu,Zn)<sub>6</sub>W<sub>2</sub>Ge<sub>6</sub>S<sub>32</sub>**

E.M. Spiridonov (1994) New germanium-molybdenum-tungsten sulfide mineral phases from the massive sulfide-polymetallic Tsumeb deposit (Namibia). *Geology of Ore Deposits*, 36, 335–341 (translation of *Geol. Rudnykh Mestorozhdenii*, 36, 370–376).

The minerals occur in the Tsumeb deposit, Namibia, typically as segregations in germanite, and as zones showing outward progression from a germanocolusite core, to the Mo-bearing mineral, to the W-bearing mineral, and to a rim of germanite. Typical sizes for the Mo-bearing mineral are 3–40 μm, maximum 150 μm; for the W-bearing mineral, 1–20 μm, and maximum 100 μm.

#### **Cu<sub>20</sub>(Fe,Zn,Cu)<sub>6</sub>Mo<sub>2</sub>Ge<sub>6</sub>S<sub>32</sub>**

Two of four electron microprobe analyses (maximum and minimum Mo contents) gave Cu 42.55, 40.12, Ag 0.00, 0.04, Fe 6.35, 6.49, Zn 0.56, 0.50, W 1.24, 5.66, Mo 5.21, 3.31, Ge 10.86, 9.01, Ga 0.15, 0.05, As 2.28, 3.56, V 0.12, 0.02, S 31.40, 30.40, sum 100.72, 99.16 wt%, corresponding to (Cu<sub>21.91</sub>Fe<sub>3.72</sub>Zn<sub>0.28</sub>)<sub>Σ25.91</sub>(Mo<sub>1.79</sub>W<sub>0.22</sub>)<sub>Σ2.01</sub>(Ge<sub>4.90</sub>Ga<sub>0.07</sub>As<sub>0.99</sub>)<sub>Σ5.86</sub>V<sub>0.08</sub>S<sub>32.04</sub> and (Cu<sub>21.47</sub>Fe<sub>3.95</sub>Zn<sub>0.26</sub>Ag<sub>0.01</sub>)<sub>Σ25.69</sub>(Mo<sub>1.17</sub>W<sub>1.05</sub>)<sub>Σ2.22</sub>(Ge<sub>4.22</sub>Ga<sub>0.02</sub>As<sub>1.61</sub>)<sub>Σ5.85</sub>V<sub>0.01</sub>S<sub>32.23</sub>. In reflected light, intense light yellow color, isotropic, no cleavage; reflectance percentages for the most Mo-rich sample (Si standard; given in 20-nm steps from 400–700 nm) are 22.7 (420), 23.4 (460), 24.8 (500), 25.4 (540), 25.7 (580), 25.1 (620), 25.7 (660), and 23.8 (700).  $VHN_{30} = 305$  (275–345); relief similar to that of germanite. The eight X-ray diffraction lines listed for the most Mo-rich sample are 3.07(100,222), 2.66(20,400), 1.884(80,440), 1.603(40,622), 1.536(5,444), 1.331(10,800), 1.220(20,662), and 1.190(10,840) Å, from which  $a = 10.64(1)$  Å and  $D_{\text{calc}} = 4.543 \text{ g/cm}^3$  for  $Z = 1$ .

#### **Cu<sub>20</sub>(Fe,Cu,Zn)<sub>6</sub>W<sub>2</sub>Ge<sub>6</sub>S<sub>32</sub>**

The most W-rich of four electron microprobe analyses gave Cu 38.35, Fe 6.69, Zn 3.12, W 9.94, Mo 0.35, Sn 0.02, Ge 9.70, Ga 1.67, As 1.18, V 0.16, S 30.35, sum 101.53 wt%, corresponding to (Cu<sub>20.41</sub>Fe<sub>4.05</sub>Zn<sub>1.61</sub>)<sub>Σ26.07</sub>(W<sub>1.83</sub>Mo<sub>0.12</sub>Sn<sub>0.01</sub>)<sub>Σ1.96</sub>(Ge<sub>4.52</sub>Ga<sub>0.81</sub>As<sub>0.53</sub>)<sub>Σ5.86</sub>V<sub>0.10</sub>S<sub>32.01</sub>. In reflected light, color variable from whitish, pale yellow, and pinkish-grayish-whitish. Isotropic, no cleavage, relief similar to that of germanite,  $VHN_{30} = 295$  (265–340); reflectance percentages (analyzed sample, and wavelengths as above) are 22.4, 23.2, 23.2, 23.6, 24.0, 24.3, 23.8, and 23.9. The strongest of the ten X-ray diffraction lines listed are 3.08(100,222), 2.67(20,400), 1.887(70,440), 1.612(50,622), and 1.225(15,662), from which  $a = 10.675(17)$  Å and  $D_{\text{calc}} = 4.736 \text{ g/cm}^3$  for  $Z = 1$ . Forms a series with the Mo analogue.

**Discussion.** These correspond to approved minerals 92–38 and 92–39. J.L.J.

#### **(Ca,REE)PO<sub>4</sub>·nH<sub>2</sub>O**

O.A. Doynikova, A.I. Gorshkov, L.N. Belova, A.V. Sivtsov, V.N. Guliy (1993) The problem of classification of

the phosphates of the rhabdophane group. Zapiski Vses. Mineral. Obshch., 122(3), 79–88 (in Russian, English abs.).

The mineral occurs as inclusions in apatite from the Aldan Shield, Yakutia, Russia. SAED and electron microprobe studies (not given) of elongate microcrystals (up to 0.5  $\mu\text{m}$  thick) showed the mineral to have hexagonal symmetry, space group  $P6_222$ ,  $a = 6.90(4)$ ,  $c = 6.39(4)$  Å, and the formula to be  $(\text{Ca}, \text{REE})\text{PO}_4 \cdot n\text{H}_2\text{O}$  with  $\text{Ca} \gg \text{REE}$  (La, Ce). The new phosphate belongs to the rhabdophane group. V.A.K.

#### Ca analogue clinojimthompsonite

H. Konishi, J. Akai, K. Kurokawa (1993) Calcic analog of clinojimthompsonite from the Oeyama ophiolite, southwest Japan. Jour. Geol. Soc. Japan, 99, 679–682.

The mineral occurs as lamellae, up to 10  $\mu\text{m}$  wide and 0.5 mm long, intergrown along (010) of tremolite in the metamorphosed Oeyama ophiolite, northwest of Kyoto, Japan. In transmitted light, colorless to slightly pinkish; in [001] sections, birefringence higher and  $n$  lower than that of tremolite. Electron microprobe analysis (one of three listed) gave  $\text{SiO}_2$  60.15,  $\text{TiO}_2$  0.05,  $\text{Al}_2\text{O}_3$  0.18,  $\text{Cr}_2\text{O}_3$  0.11, Fe as FeO 1.18, MnO 0.07, MgO 26.18, CaO 9.01,  $\text{Na}_2\text{O}$  0.10,  $\text{K}_2\text{O}$  0.01, sum 97.4 wt%, corresponding to  $(\text{Ca}_{1.924}\text{Na}_{0.039}\text{K}_{0.003})_{\Sigma 1.966}(\text{Mg}_{7.774}\text{Fe}_{0.197}\text{Mn}_{0.012}\text{Cr}_{0.017}\text{Ti}_{0.008}\text{Al}_{0.027})_{\Sigma 8.035}(\text{Si}_{11.984}\text{Al}_{0.016})_{\Sigma 12.000}\text{O}_{32}(\text{OH})_4$ , ideally  $\text{Ca}_2(\text{Mg}, \text{Fe})_8\text{Si}_{12}\text{O}_{32}(\text{OH})_4$ . Electron diffraction study indicated monoclinic symmetry and extinctions consistent with space group  $C2/c$ ,  $a \sin \beta = 9.3$  Å,  $b = 27$  Å; cleavage angles  $141^\circ$ . Also present is Ca-rich chesterite, to 1500 Å width, having monoclinic symmetry and approximate cell dimensions  $a \sin \beta = 9.3$  Å,  $b = 45$  Å.

**Discussion.** See also *Mineral. Mag.*, 58, 1–20, 1994, for another report of the possible occurrence of the monoclinic polymorph of chesterite. J.L.J.

#### K analogue of nenadkevichite

R.K. Rastsvetaeva, R.A. Tamazyan, D.Yu. Pushcharovsky, T.N. Nadezhina (1994) Crystal structure and microtwinning of K-rich nenadkevichite. Eur. Jour. Mineral., 6, 503–509.

Electron microprobe analysis gave  $\text{Na}_2\text{O}$  4.69,  $\text{K}_2\text{O}$  11.12, CaO 0.44, SrO 1.46, BaO 1.72,  $\text{TiO}_2$  10.95,  $\text{Nb}_2\text{O}_5$  22.22,  $\text{SiO}_2$  40.62,  $\text{H}_2\text{O}$  6.78 (by difference), sum 100 wt%, corresponding to  $(\text{Na}_{0.90}\text{K}_{1.40})(\text{Ca}, \text{Sr}, \text{Ba})_{0.20}(\text{Ti}_{0.81}\text{Nb}_{0.99})[\text{Si}_4\text{O}_{12}]\text{O}_{0.90}(\text{OH})_{1.10} \cdot 2.23\text{H}_2\text{O}$  for  $\text{Si} = 8$ . X-ray structure study ( $R = 0.08$ ) for a twinned crystal indicated monoclinic symmetry, space group  $Cm$ ,  $a = 14.692(4)$ ,  $b = 14.164(4)$ ,  $c = 7.859(3)$  Å,  $\beta = 117.87(2)^\circ$ ,  $D_{\text{calc}} = 2.67$  g/cm<sup>3</sup>,  $Z = 4$ . The structurally derived formula is  $\text{Na}_{0.6}\text{K}_{1.5}(\text{Nb}_{0.6}\text{Ti}_{0.4})(\text{Nb}_{0.5}\text{Ti}_{0.5})[\text{Si}_4\text{O}_{12}](\text{O}, \text{OH})_2 \cdot 1.6\text{H}_2\text{O}$ , which is the K-rich analogue and monoclinic polymorph of nenadkevichite. The X-ray powder pattern is reported to be similar to that of orthorhombic nenadkevichite. The

mineral occurs in carbonatites at Vuorijarvi, Kola Peninsula, Russia. J.L.J.

#### $\text{Ca}_3\text{Ti}(\text{Al}, \text{Ti})_2(\text{Si}, \text{Al})_3\text{O}_{14}$

J.M. Paque, J.R. Beckett, D.J. Barber, E.M. Stolper (1994)

A new titanium-bearing calcium aluminosilicate phase: I. Meteoritic occurrences and formation in synthetic systems. *Meteoritics*, 29(5), 673–682.

D.J. Barber, J.R. Beckett, J.M. Paque, E. Stolper (1994)

A new titanium-bearing calcium aluminosilicate phase: II. Crystallography and crystal chemistry of grains formed in slowly cooled melts with bulk compositions of calcium-aluminum-rich inclusions. *Meteoritics*, 29(5), 682–691.

D.J. Barber, S.O. Agrell (1994) A new titanium-bearing

calcium aluminosilicate phase: III. Crystals from a mixer furnace slag. *Meteoritics*, 29(5), 691–695.

The mineral is present as typically tabular, occasionally anhedral, inclusions to <40  $\mu\text{m}$  in maximum dimension, commonly at the intersection of the {001} and {110} cleavages of melilite, which occurs in numerous coarse-grained inclusions in the Allende and Essebi meteorites. Electron microprobe analysis (one of nine listed) gave CaO 32.2, MgO 0.77,  $\text{Al}_2\text{O}_3$  19.5,  $\text{TiO}_2$  20.4,  $\text{SiO}_2$  25.7, sum 98.6 wt%, corresponding to  $\text{Ca}_{3.17}\text{Mg}_{0.11}\text{Al}_{2.11}\text{Ti}_{1.41}\text{Si}_{2.37}$ , ideally  $\text{Ca}_3\text{Ti}(\text{Al}, \text{Ti})_2(\text{Si}, \text{Al})_3\text{O}_{14}$  on the basis of 14O and 9 total cations. In thin section, colorless, birefringent, parallel extinction. Crystallizes as a synthetic phase with melilite at <1190 °C, and also found in a furnace slag. In the latter, optically uniaxial positive,  $\omega = 1.768$ ,  $\epsilon = 1.818$ ; rhombohedral symmetry, possible space groups  $P3m1$  or  $P31m$ ,  $a = 7.91$ ,  $c = 4.92$  Å. Strongest lines of the powder pattern are 3.087(100,111), 2.814(100,201), 2.300(90, 121,102,030), and 1.784(55,122,221,131). J.L.J.

#### New Data

##### Alunite-jarosite

F. Novák, J. Jansa, I. Prachař (1994) Classification and nomenclature of the alunite-jarosite and related mineral groups. *Věstník Českého geol. ústavu*, 69(2), 51–57.

Minerals of the alunite-jarosite type are characterized by the general formula  $\text{AB}_3(\text{XO}_4)_2(\text{OH})_6$  in which B is typically Fe or Al, and  $\text{XO}_4$  is  $\text{SO}_4$ ,  $\text{PO}_4$ , or  $\text{AsO}_4$ . Extensive, if not complete, solid solution for  $\text{SO}_4$ - $\text{PO}_4$ - $\text{AsO}_4$  is known, and it is proposed for this ternary system that the boundaries for mineral names be set at 33.3 and 66.6 mol%  $\text{XO}_4$  on the sides of the composition triangle. Thus, the triangle consists of six segments on the basis of  $\text{XO}_4$ , and the nomenclature within each segment depends on whether Fe or Al predominates (e.g., alunite for Al > Fe, and jarosite for Fe > Al, both with  $\text{SO}_4 > 66.6$  mol% and K dominant in A). Departures from trigonal symmetry can be distinguished by appropriate suffixes, e.g., gorceixite *M* to indicate monoclinic gorceixite.

The classification system incorporates the unapproved or unpublished names plumboalunite, arsenogorceixite, and arsenowaylandite. Reanalysis (data not given) of type *kemmlitzite* showed it to be PO<sub>4</sub>-dominant, and *minamiite* is redefined as a calcian natroalunite.

**Discussion.** Though the proposals have not been approved or even submitted to the CNMMN, this is a useful review of a complex system that already contains more than 40 approved names and still has room for growth. One of the major problems is historical in that minerals such as beudantite were assigned the formula PbFe<sub>3</sub>(AsO<sub>4</sub>)(SO<sub>4</sub>)(OH)<sub>6</sub>, with equality of AsO<sub>4</sub> and SO<sub>4</sub> (see also corkite, hinsdalite, svanbergite, woodhouseite), whereas it has long been known that XO<sub>4</sub> is represented by AsO<sub>4</sub>-SO<sub>4</sub>-PO<sub>4</sub> solid solutions. As an example of the problem, rather than redefining the PbFe<sub>3</sub>(XO<sub>4</sub>) minerals as a ternary system with plumbojarosite (SO<sub>4</sub>), beudantite (AsO<sub>4</sub>), and corkite (PO<sub>4</sub>) at the apices, the solid-solution boundaries were set at 75 and 25% (*Am. Mineral.*, 72, 178–187, 1987), with the PO<sub>4</sub> and AsO<sub>4</sub> end-members left, at that time, unnamed. Thus, the IMA-approved system allows for five names in each AsO<sub>4</sub>-PO<sub>4</sub>-SO<sub>4</sub> ternary, and the classification abstracted above expands this to six. A CNMMN subcommittee was appointed in 1993 to deal with the nomenclature in this group of minerals; a preliminary report was presented at the IMA meeting in Pisa in 1994, but the final recommendations have not yet been made. J.L.J.

#### Choloalite

D.W. Powell, R.G. Thomas, P.A. Williams, W.D. Birch, I.R. Plimer (1994) Choloalite: Synthesis and revised chemical formula. *Mineral. Mag.*, 58, 505–508.

Choloalite, originally assigned the formula CuPb(TeO<sub>3</sub>)<sub>2</sub>·H<sub>2</sub>O, was synthesized by dry fusion. Indexing of the X-ray powder pattern gave a cubic cell with  $a = 12.514 \text{ \AA}$ ;  $D_{\text{calc}} = 6.323 \text{ g/cm}^3$  for CuPb(TeO<sub>3</sub>)<sub>2</sub> and  $Z = 12$ . One of the unnamed tellurites associated with type balyakinite (*Am. Mineral.*, 66, p. 436, 1981) matches the new formula for choloalite. J.L.J.

#### Ewaldite

A.V. Voloshin, V.V. Subbotin, V.M. Yakovenchuk, Ya.A. Pakhomovskii, Yu.P. Menshikov, T.N. Nadezhdina, D.Yu. Pushcharovskii (1992) New data on ewaldite. *Zapiski Vseros. Mineral. Obshch.*, 121(1), 56–67 (in Russian, English abs.).

Electron microprobe analyses of ewaldite from the carbonates of the Vuorijarvi alkali-ultramafic massif (two specimens) and Khibiny alkaline massif (Kola Peninsula, Russia) gave, respectively: Na<sub>2</sub>O 3.30–4.22, 3.53, CaO 5.34–5.09, 5.57, SrO 2.14–1.85, 6.72, BaO 41.37–41.14, 34.60, Y<sub>2</sub>O<sub>3</sub> 0.00–0.00, 6.48, La<sub>2</sub>O<sub>3</sub> 2.19–1.00, 0.80, Ce<sub>2</sub>O<sub>3</sub> 6.55–2.41, 1.38, Pr<sub>2</sub>O<sub>3</sub> 1.21–1.16, 0.00, Nd<sub>2</sub>O<sub>3</sub> 1.64–6.27, 0.16, Gd<sub>2</sub>O<sub>3</sub> 0.00–0.00, 0.29, Tb<sub>2</sub>O<sub>3</sub> 0.00–0.00, 0.09, Dy<sub>2</sub>O<sub>3</sub>

0.00–0.00, 0.36, CO<sub>2</sub> 24.09–24.72, 25.46, H<sub>2</sub>O 11.82–9.94, 12.55 (CO<sub>2</sub> and H<sub>2</sub>O calculated for  $\Sigma_{\text{cations}} = 2$ ), sum 100 wt%. All specimens investigated contain 9.9–12.6 wt% molecular H<sub>2</sub>O. Their chemical composition is similar to that of mckelveyite, and the new general formula for these minerals is proposed as (Ca,Na,REE)-(Ba,Sr)(CO<sub>3</sub>)<sub>2</sub>·nH<sub>2</sub>O. Single-crystal and powder X-ray studies of ewaldite indicated hexagonal symmetry, space group  $P6_3mc$ ,  $a = 5.318(2)$ ,  $c = 12.837(7) \text{ \AA}$ ,  $Z = 2$ . Verification of the crystal structure ( $R = 0.077$ ) confirmed the presence of molecular H<sub>2</sub>O. The conclusion is that ewaldite and mckelveyite are polymorphous rather than two minerals with distinct compositions. V.A.K.

#### Monsmedite

J. Zemann (1993) What is monsmmedite. *Romanian Jour. Mineral.*, 76(1), 97–98.

Samples labeled monsmmedite from Transylvania, and which agree well with the macroscopic properties and X-ray powder pattern of the mineral, have been found by single-crystal X-ray study to be isometric, space group  $Fd\bar{3}c$ ,  $a = 25.29(2) \text{ \AA}$ . The results indicate that monsmmedite may be voltaite. J.L.J.

#### Nagyagite

E.M. Spiridonov (1991) Nagyagite AuPb<sub>5</sub>Te<sub>4-x</sub>Sb<sub>x</sub>S<sub>6</sub>,  $x = 0-2$  (new data on the chemical composition). *Novye Dannye Mineral.*, 37, 128–138 (in Russian).

The chemical composition of museum specimens of nagyagite from Sacarimb and Baja de Ariesh (Romania), Manka (Kazakhstan), Kalgoorlie (Australia), and Zod (Armenia) were studied. Electron microprobe analyses of the mineral from Sacarimb (mean of 23) gave Pb 54.37, Au 10.64, Sb 8.45, Te 17.59, S 10.37, sum 101.42 wt%, corresponding to Pb<sub>4.956</sub>Au<sub>1.016</sub>Sb<sub>1.286</sub>Te<sub>2.60</sub>S<sub>6.062</sub>. Analyses of the mineral from Baja de Ariesh (mean of 13) gave Pb 53.84, Au 10.75, Sb 7.82, Te 18.91, S 10.06, Se 0.05, sum 101.43 wt%, corresponding to Pb<sub>4.915</sub>Au<sub>1.032</sub>Sb<sub>1.215</sub>Te<sub>2.805</sub>S<sub>5.93</sub>; for Manka (mean of three) Pb 53.06, Au 10.83, Sb 7.05, Bi 0.17, Te 19.48, S 10.30, sum 100.89 wt%, corresponding to Pb<sub>4.860</sub>Au<sub>1.044</sub>Sb<sub>1.099</sub>Te<sub>2.898</sub>S<sub>6.098</sub>; for Kalgoorlie (mean of ten) Pb 54.20, Au 10.43, Sb 8.69, Bi 0.49, Te 17.27, S 9.92, sum 101.00 wt%, corresponding to Pb<sub>5.038</sub>Au<sub>1.020</sub>Sb<sub>1.375</sub>Te<sub>2.606</sub>S<sub>5.459</sub>; for Zod (mean of seven) Pb 54.14, Au 10.90, Sb 7.95, Bi 0.20, Te 17.05, S 9.58, sum 99.82 wt%, corresponding to Pb<sub>5.104</sub>Au<sub>1.080</sub>Sb<sub>1.278</sub>Te<sub>2.609</sub>S<sub>5.867</sub>. The ideal formula is Pb<sub>5</sub>AuTe<sub>4-x</sub>Sb<sub>x</sub>S<sub>6</sub> ( $x = 0-2$ ) or Pb<sub>5</sub>Au(Te,Sb)<sub>4</sub>S<sub>6</sub>. Isomorphism of Sb for Te is assumed.

**Discussion.** This formula, stated as calculated on the basis of 16 atoms per formula unit, differs from the formula Pb<sub>5</sub>Au(Sb,Bi)Te<sub>2</sub>S<sub>6</sub> of “nagyagite” from Jilové (*Am. Mineral.*, 80, p. 188, 1995), and probably the composition of nagyagite varies from Pb<sub>5</sub>Au(Sb,Bi)Te<sub>2</sub>S<sub>6</sub> to Pb<sub>5</sub>AuSbTe<sub>3</sub>S<sub>6</sub>. V.A.K.

G. Simon, D.H.M. Alderton, T. Bleser (1994) Arsenian nagyagite from Sacarimb, Romania: A possible new mineral species. *Mineral. Mag.*, 58, 473–478.

The mean of 47 electron microprobe analyses gave Pb 55.8, Au 10.5, Ag < 0.1, As 0.1, Sb 7.4, Te 15.0, S 10.9, sum 99.8 wt%, corresponding to  $Pb_5Au_{0.99}As_{0.04}Sb_{1.14}Te_{2.18}S_{6.28}$ . Commonly present is As-rich zoning, and this variant occurs as inclusions in stützite and as rims, 20–50  $\mu\text{m}$  wide, on tellurides. Rims are anhedral, and inclusions are anhedral to euhedral, the latter with a hexagonal outline. Electron microprobe analysis of the As-rich variant (maximum As found) gave Pb 54.2, Au 11.5, Ag 0.1, As 5.5, Sb 0.4, Te 17.5, S 11.5, sum 100.7 wt%, corresponding to  $Pb_{5.00}Au_{1.12}As_{1.40}Sb_{0.06}Te_{2.62}S_{6.85}$  for Pb = 5; the mean of 53 analyses of the As-bearing mineral gave  $Pb_{5.00}Au_{1.00}As_{1.04}Sb_{0.51}Te_{2.76}S_{6.81}$ . In reflected light, low bireflection and pleochroism, and a slightly lower reflectance than that of As-poor nagyagite. The results suggest that the mineral is the As analogue of nagyagite. A positive correlation between (Sb + As) and Te suggests that they do not substitute for each other. **J.L.J.**

C.J. Stanley, A.C. Roberts, D.C. Harris (1994) New data for nagyagite. *Mineral. Mag.*, 58, 482–486.

The average and range of 61 electron microprobe analyses of nagyagite from Sacarimb, Romania (type locality), gave Pb 56.76 (55.86–57.53), Au 7.47 (6.87–7.99), Ag 0.10(0.00–0.35), Cu 0.02 (0.00–0.12), Fe 0.02 (0.00–0.08), Sb 7.68 (7.55–8.19), Te 16.97 (16.55–17.30), S 10.83 (10.52–11.04), sum 99.85 wt%, which for 40 atoms corresponds to  $Pb_{12.94}Au_{1.79}Ag_{0.04}Fe_{0.01}Sb_{2.98}Te_{6.28}S_{15.95}$ , ideally

$Pb_{13}Au_2Sb_3Te_6S_{16}$ . Single-crystal X-ray study indicated orthorhombic (pseudotetragonal) symmetry, space group *Bbmm*, *Bb2<sub>1</sub>m*, or *Bbm2*,  $a = 8.336$ ,  $b = 30.10$ ,  $c = 8.290$  Å,  $D_{\text{calc}} = 7.47$  g/cm<sup>3</sup> for the empirical formula and  $Z = 2$ . Strongest lines of the powder pattern (114-mm Debye-Scherrer, Cu radiation) are 3.023(100,0.10.0), 2.829(80,232), 2.431(40,272), 2.081(50,410), and 1.511(40,0.20.0).

**Discussion.** If a formula with 40 atoms is accepted, the possible As analogue has the composition  $Pb_{11.73}Au_{2.63}(As,Sb)_{3.43}Te_{6.15}S_{16.07}$ . As is noted by Stanley et al., abstracts by other authors reporting additional data on nagyagite appeared in 1993, but to date no one has determined the crystal structure and conclusively established the compositional limits for the mineral. **J.L.J.**

### Smirnovskite

O.A. Doynikova, A.I. Gorshkov, L.N. Belova, A.V. Sivtsov, V.N. Guliy (1993) The problem of classification of the phosphates of the rhabdophane group. *Zapiski Vseros. Mineral. Obshch.*, 122(3), 79–88 (in Russian, English abs.).

Investigation of a museum specimen (Fersman Mineralogical Museum, Moscow, Russia), of type material of smirnovskite from the Transbaikal region confirmed that the mineral is brockite. SAED and electron microprobe studies (not given) showed the mineral to have hexagonal symmetry, space group  $P6_222$ ,  $a = 7.12(4)$ ,  $c = 6.47(4)$  Å, and the formula to be  $(Th,Ca)PO_4 \cdot nH_2O$ . **V.A.K.**