

NEW MINERAL NAMES*

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Archerite*

P. J. Bridge (1977) Archerite, $(K, NH_4)H_2PO_4$, a new mineral from Madura, Western Australia. *Mineral. Mag.*, 41, 33-35.

Archerite occurs with biphosphammite, $NH_4H_2PO_4$, (*Am. Mineral.*, 58, p. 806) and other phosphates and saline minerals as a constituent of stalactites and crusts in Petrogale Cave, 36 km east of Madura. The tetragonal crystals, up to 2 mm in length, have D 2.23, ω 1.513, ϵ 1.470, all close to those of artificial KH_2PO_4 . Partial analysis gave K_2O 10.8, NH_3 3.46 percent, corresponding to $[K_{0.74}(NH_4)_{0.26}]H_2PO_4$. Cell dimensions are not reported but are close to those of artificial KH_2PO_4 , a 7.448, c 6.977 Å, space group $I\bar{4}2d$, $Z = 4$. Archerite is relatively soft, has no distinct cleavage, is white and water-soluble. The name is for Dr. Michael Archer, Curator of Mammals, Queensland Museum, who first drew attention to the deposit. A.P.

Feroxyhyte*

F. V. CHUKHROV, B. B. ZVYAGIN, A. I. GORSHKOV, L. P. ERMILOVA, V. V. KOROVUSHKIN, E. S. RUDNITSKAYA AND N. YU. YAKUBOVSKAYA (1976) Feroxyhyte, a new modification of $FeO(OH)$. *Izvest. Akad. Nauk SSR, Ser. geol.*, no. 5, 5-24 (in Russian).

It is shown that synthetic delta- $FeO(OH)$ consists of two substances, both hexagonal, delta- $FeO(OH)$, ordered, magnetic, and delta- $FeO(OH)$, disordered or slightly ordered, and non-magnetic. The latter, named feroxyhyte, for the constituents, has been found in iron-manganese concretions from the Pacific Ocean and from the Baltic, White, and Kara Seas, and also in gley soils. Analyses of the synthetic material are given. The DTA curve shows endothermic breaks at about 160° and about 320°, the latter corresponding to the loss of hydroxyl water. Infrared spectra are given.

X-ray data are given with details of the structure. The mineral is hexagonal, a 2.93, c 4.60 Å, $Z = 1$, G 4.20 calc. The strongest lines are 2.54 (10)(100), 2.23 (5)(101), 1.69 (3)(102), 1.47 (8)(110). The mineral is unstable and is transformed in air to goethite.

Samples are preserved in the Fersman Mineralogical Museum, Moscow. M.F.

Fletcherite*

J. R. Craig and A. B. Carpenter (1977) Fletcherite, $Cu(Ni, Co)_2S_4$, a new thiospinel from the Viburnum Trend (new lead belt), Missouri. *Econ. Geol.*, 72, 480-486.

Electron microprobe analyses on 39 samples show Cu 12.4-22.5, Ni 19.1-36.5, Co 9.5-17.0, Fe 0.2-1.2, S 38.3-41.7, with compositional range $Cu_{0.67}Ni_{2.11}Co_{0.61}Fe_{0.01}S_{4.00}$ to $Cu_{1.13}Ni_{1.04}Co_{0.84}Fe_{0.06}S_{4.00}$. X-ray powder data for material with ratio Cu:Ni:Co:Fe = 24:58.4:17:0.7 showed strongest lines (of 22 given) 2.87 (m)(113), 2.39 (m)(004), 1.83 (S)(115), 1.68 (VS)(044), 1.37 (m)(444), 1.24 (m)(731), 1.19 (m)(800), 0.97 (m)(844), corresponding to a unit cell $a = 9.520$ Å, $Z = 8$. Space group is assumed to be $Fd\bar{3}m$, but as with other members of the linnaeite group may actually be $F\bar{4}3m$. The mineral is steel-gray, luster metallic. Hardness (by Richard Hagni) 446-464 (25 g load), 368-446 (15 g load) kg/sq mm. In reflected light creamy white, isotropic, reflectance (D. J. Vaughn) against WTiC standard at 420 nm, 36.4; 500, 42.5; 546, 43.4; 589, 45.3; 640, 43.8 percent.

The mineral occurs in crystals ranging from less than 1 to 200 microns, disseminated in bornite, chalcopyrite, and digenite in copper-rich pods in the Fletcher Mine, Reynolds County, S.E. Missouri. The name is for the mine. Type material is at the Smithsonian Institution, British Museum, and Royal Ontario Museum. M.F.

Gianellaite*

George Tunell, J. J. Fahey, F. W. Daugherty and G. V. Gibbs (1977) Gianellaite, a new mercury mineral. *Neues Jahrb. Mineral., Monatsh.*, 119-131.

Microchemical analysis by JJF on samples 5-50 mg. gave Hg 83.6, SO_4 8.5, N (by F. W. Brown) 2.9, Cl, MoO_3 , H_2O none, residue (SiO_2) 0.2, sum 95.2 percent, corresponding to the formula $HgSO_4 \cdot Hg_3N_2$, or $(NHg_2)_2(SO_4)$. Spectrographic study showed Si trace. The absence of water was verified by infrared analysis. The mineral is not attacked at 20-100° by $H_2SO_4(1+1)$, conc. HNO_3 , or HF. Decomposed by conc. HCl at room temperature. Darkens when heated above 130°C, turns white at 400°C, volatilizes. Precession photographs showed the mineral to be cubic, space group $F\bar{4}3m$, $a = 9.5215$ Å, $Z = 4$, G calc 7.13, meas 7.19. The strongest X-ray lines (33) are 5.511 (8)(111), 2.872 (10)(113), 2.743 (10)(222), 2.371 (7)(004), 1.679 (7)(044), 1.432 (7)(226).

The mineral occurs as rosettes of flattened subhedral crystals, rarely as euhedral crystals 0.2-1.0 mm. in diameter of distorted octahedra. Color straw yellow. H about 3. Isotropic, n 2.085. It occurs in the Mariposa Mine, Terlingua district, Brewster County, Texas, associated with terlinguaite, calomel, montroydite, native Hg, and cinnabar, on fracture surfaces and in veinlets in limestone; it is a late-formed mineral.

The name is for Professor Emeritus Vincent Paul Gianella, Mackay School of Mines, University of Nevada. Type material is at the Smithsonian Institution, Washington.

Note. Gianellaite is very similar to mosesite in composition, differing in not containing Cl. The X-ray patterns are very similar; gianellaite shows a line 1.449 (4) not noted in mosesite. The unit cell of mosesite has a 28.618 Å. M.F.

* Minerals marked with an asterisk after the name were approved before publication by the Commission on New Minerals and Mineral Names of the International Mineralogical Association.

Kusuite*

MICHEL DELIENS AND PAUL PIRET (1977) La kusuite, $(\text{Ce}^{3+}, \text{Pb}^{2+}, \text{Pb}^{4+})\text{VO}_4$, nouveau mineral. *Bull. Soc. fr. Mineral. Cristallogr.*, 100, 39-41.

Microprobe analysis gave V_2O_5 31.76, 31.83; Ce_2O_3 35.20, 36.41; PbO 17.22, 16.88; PbO_2 18.46, 18.08; sum 102.64, 103.20 percent. The lead was divided equally between Pb^{2+} and Pb^{4+} , the presence of both having been found by E.S.C.A. Qualitative tests showed no other cations, including La. The analyses give $(\text{Ce}_{0.60}^{3+}\text{Pb}_{0.22}^{2+}\text{Pb}_{0.22}^{4+})\text{V}_{0.98}\text{O}_4$.

X-ray study showed the mineral to be tetragonal, space group $I4_1/amd$, a 7.35, c 6.56A, $a:c = 1:0.8925$, $Z=4$, G (calc) 5.30. The strongest lines (20 given) are 4.89 (50)(101), 3.678 (100)(200), 2.766 (90)(112), 2.594 (40)(220), 1.891 (70)(312), 1.638 (40)(420). The structure is of the zircon type.

The mineral occurs as black crystals of max. dimension 1 mm, showing {101}. Streak rust-brown. Microhardness 440 kg/sq mm with 100 g load (= 4.5 Mohs). No cleavages were noted. Optically uniaxial, neg., birefringence strong, refractive indices > 2.0, reflectances (Na) 17-21 percent. Color in section honey-yellow.

The mineral occurs in the oxidation zone of the Kusu deposit, 85 km SW of Kinshasa, Zaire, associated with mottramite, chervetite, cuprite, diopside, heyite, malachite, plancheite, and vanadinite.

The name is for the locality. Type material is at the Musée Royale Afrique Centrale, Tervuren, Belgium. **M.F.**

Laihunite

Laihunite Research Group, Guiyang Institute of Geochemistry, Academia Sinica and Geological Team 101, Liaoning Metallurgical and Geological Prospecting Company (1976) Laihunite, a new iron silicate mineral. *Geochimica*, 2, 95-103 (in Chinese with English abstract).

X-ray laboratory, Guiyang Institute of Geochemistry, Academia Sinica (1976) The crystal structure of laihunite. *Geochimica*, 2, 104-105 (in Chinese with English abstract).

Three chemical analyses gave: SiO_2 31.00, 31.07, 31.85; Al_2O_3 -, -, 0.065; Fe_2O_3 43.57, 44.24, 45.07; FeO 25.50, 23.64, 22.52; MgO -, 0.87, 0.47; CaO -, 0.21, 0.47; sum 100.07, 100.03, 100.45 percent, corresponding to $\text{Fe}_{0.99}^{3+}\text{Fe}_{0.64}^{2+}\text{Si}_{0.94}\text{O}_4$, $\text{Fe}_{1.00}^{3+}\text{Fe}_{0.59}^{2+}\text{Mg}_{0.04}\text{Si}_{0.99}\text{O}_4$, and $\text{Fe}_{1.01}^{3+}\text{Fe}_{0.56}^{2+}\text{Mg}_{0.08}\text{Si}_{0.97}\text{O}_4$ respectively. Probe analysis showed homogeneous distribution of Si and Fe in the mineral. Spectrographic analysis showed trace of Al, Mn, Cu, and Ba.

The mineral is orthorhombic, $Pb2_1m$, $Pbm2$ or $Pbmm$, with $a = 4.800$ (5), $b = 10.238$ (5), $c = 5.857$ (5)A. The cell contains 4($\text{Fe}^{3+}\text{Fe}_{0.5}^{2+}\text{SiO}_4$). The strongest X-ray lines (26 given) are: 3.78 (6)(021); 3.47 (9)(120); 2.78 (8)(130); 2.520 (10)(022, 131); 2.405 (6)(200, 112); 2.260 (5)(140); 1.750 (7)(240, 222). The powder pattern differs from that of fayalite in relative intensities, extinction rules, and smaller d -values. The structure (in space group $Pb2_1m$), solved by multiple superposition method using two Patterson projections and by geometrical considerations, was confirmed by electron density projections. Intensity data used were obtained visually from $\text{CuK}\alpha$ Weissenberg photographs, using a calibrated intensity strip. The structure is basically similar to that of fayalite except that the four Fe^{3+} atoms are ordered in two sets of two-fold positions (corresponding to M_2 in olivine, GYC) and the two Fe^{2+} atoms are statistically distributed over a four-fold position (M_1 in olivine, GYC). Refinement of the structure is in progress.

DTA curve showed an exothermic peak at 713°C. For material

heated for two hours in air at 900°C the peak was no longer observed on the DTA curve. Mossbauer parameters of the mineral are: Fe^{2+} quadrupole splitting = 2.5 mm/sec, chemical shift = 1.25 mm/sec; Fe^{3+} quadrupole splitting = 0.95 mm/sec and chemical shift = 0.47 mm/sec. The $\text{Fe}^{3+}:\text{Fe}^{2+}$ ratio derived from areas under the peaks is 1:0.65. IR (K Br pellets) absorption bands (cm^{-1}) are: 1110 (vw), 1040 (vw), 955 (vs), 885 (m), 830 (m), 640 (w), 590 (w), 535 (vw), 510 (vw), 460 (vw), 410 (vw). The spectrum for material heated to 700°C showed significant differences, suggesting that a phase change occurred.

The mineral is black, opaque, with pale-brown streak and sub-metallic to metallic luster, weakly to moderately magnetic. Crystals are thick tabular to short prismatic, usually 0.3 to 0.65 mm in size. Cleavages {100}, {010} perfect, {001} less perfect. $G = 3.92$, $\text{VHN} = 890 \text{ kg/mm}^2$ or 6.1 on Moh's scale.

In ultra-thin-sections (several microns) the mineral is brownish red, slightly translucent with parallel extinction. In reflected light the mineral is gray, weakly anisotropic, with indistinct birefringence and slightly heterogeneous extinction. Reflectances (spherulite as standard) are: 2.39 (red), 13.43 (green), 12.39 percent (yellow).

The mineral occurs in a Precambrian metamorphic iron deposit, Lai-He Village, northeastern China. It is commonly associated with quartz, hypersthene, and magnetite. The mineral name is for the locality. **G.Y.C.**

Luetheite*

S. A. Williams (1977) Luetheite, $\text{Cu}_2\text{Al}_2(\text{AsO}_4)_2(\text{OH})_4 \cdot \text{H}_2\text{O}$, a new mineral from Arizona, compared with chenevixite. *Mineral. Mag.*, 41, 27-32.

Luetheite was found at a small prospect in Santa Cruz County as minute crystals in silicified rhyolite porphyry with chenevixite and hematite. Duplicate chemical analyses averaged CuO 28.9, Al_2O_3 18.4, As_2O_5 40.5, H_2O 9.3 percent, sum 97.1, the remainder presumably being insoluble residue. The monoclinic crystals, tabular on {100}, with maximum dimensions 0.2 mm, have an apparent symmetry $2/m$. The crystals are indian blue inclining to greenish, $H = 3$, brittle, cleavage {100} distinct. Cell dimensions are a 14.743, b 5.093, c 5.598 A, $\beta = 101^\circ 49'$, $Z = 2$, D (meas) 4.28, (calc) 4.40, diffraction symbol $P2_1/*$. The strongest lines of the powder pattern are: 3.498 (10)(310, 111); 7.208 (7)(200); 2.507 (5)(120, 510). The refractive indices are: α 1.752, β 1.775, γ 1.796, $2V_\gamma$ (calc) 88° , dispersion is moderate $\gamma > \rho > \alpha$ || [010], γ : [001] 10° in obtuse β ; feebly pleochroic in pale blue in thin section. The name is for R. D. Luethe, geologist for the Phelps Dodge Corporation, who first found the new mineral.

Luetheite is the Al analogue of chenevixite, $\text{Cu}_2\text{Fe}_2(\text{AsO}_4)_2(\text{OH})_4 \cdot \text{H}_2\text{O}$. Data are given for chenevixite from several localities. Its cell dimensions are: a 15.006, b 5.189, c 5.724, $\beta = 102^\circ 15'$, as determined on material from Las Animas, Sonora, Mexico. **A.P.**

Nanlingite

Gu Xiongfei, Ding Kuishou, and Xu Yingnian (1976) A new arsenite mineral from southern China. *Geochimica*, 2, 107-112 (in Chinese with English abstract).

Chemical analysis supplemented by spectrographic and semi-quantitative probe analyses gave: Na_2O 1.81, CaO 11.74, Li_2O 1.22, MgO 25.04, MnO 0.21, Fe_2O_3 7.09, Al_2O_3 0.98, As_2O_3 44.11,

H₂O 0.60, F 13.64, -O = F 5.74, sum 100.70 percent, corresponding to (Na_{0.216}Ca_{0.778}) (Mg_{2.300}Li_{0.303}Mn_{0.011}Fe_{0.061}³⁺)(As_{1.651}Fe_{0.278}Al_{0.071}) O_{5.094} (OH)_{0.247}F_{2.659}, or ideally CaMg₃F₃ (AsO₃)₂. Spectrographic analysis showed trace to strong trace of Be, Ba, Sn, Mo, Ti, Si, Pb, Ni, Bi, Ag, and Zr.

Single-crystal X-ray studies showed the mineral to be trigonal, *R3m* or *R3̄m*, with *a* = 10.24(5), *c* = 25.76(5) Å, *a*_{rh} = 10.42(5) Å and $\alpha = 58^\circ 50'$; *Z*_{rh} = 5, *Z*_{hex} = 15. Strongest lines of partially indexed powder pattern (60 lines given) are: 8.35 (9)(101), 2.78 (10)(303), 2.425 (7)(312), 1.730 (8)(503), 1.699 (8)(331), 1.460 (7)(517, 50, 10), 1.104 (6)(718), 1.079 (6)(722). Well-formed crystals are very rare; incomplete crystals showed well-developed basal pinacoid and poorly developed rhombohedron. Determination of the structure is in progress.

Color brownish red; streak pale yellow; luster vitreous. Oxidized surfaces are dark brown. VHN = 107 kg/mm², corresponding to 2.3 on Moh's scale. *G* (obs) = 3.927, (calc) = 3.993. Under polarizing microscope the mineral is deep red, transparent, uniaxial negative; $\omega = 1.82$, $\epsilon = 1.78$, with abnormal red interference color. Grain size varies from 0.1 to 2 mm, average 0.2 mm. In thin section the mineral occurs in irregular grains, occasionally in pseudoporphyrific tabular crystals. On hand specimens it occurs as dendritic aggregates. The mineral occurs in the outer zone of contact between greisenized granite and Cretaceous dolomitic limestone in the Nan Ling area, China. It is associated with fluorite, fluoborite, protolithionite, magnesiadolomite, arsenopyrite, pyrrhotite, gahnite, and nigerite. The mineral name is for the locality.

Discussion

Minor error exists in the original calculation of the chemical formula. An alternative interpretation of the analysis, based on the observed cell volume, specific gravity, and recalculation of the analysis to 100 percent, gives: (Ca_{0.96}Na_{0.27}) (Mg_{2.83}Fe_{0.41}³⁺Li_{0.37}Al_{0.09}Mn_{0.01}) (AsO₃)_{2.04}F_{3.28}(OH)_{0.30}O_{0.02}, with *Z* = 4. The ideal formula then becomes CaMg₄(AsO₃)₂F₄. Density calculated for the ideal composition is 3.925 g/cm³. G.Y.C.

Nickelblödite (Nickelbloedite)*

E. H. Nickel and P. J. Bridge (1977) Nickelblödite, Na₂Ni(SO₄)₂·4H₂O, a new mineral from Western Australia. *Mineral. Mag.*, 41, 37–41.

Nickelblödite, the nickel analogue of blödite [Na₂Mg(SO₄)₂·4H₂O], has been discovered in nickel mines at Kambalda and Carr Boyd Rocks in Western Australia. The Kambalda sample, found in an underground opening, has a composition corresponding to Na_{2.02}(Ni_{0.78}Mg_{0.14}Fe_{0.06})(SO₄)_{2.00}·3.17H₂O. The sample from Carr Boyd Rocks, collected from an open pit, is a more magnesian variety, Na_{1.83}(Ni_{0.55}Mg_{0.46}Cu_{0.03}Co_{0.02})(SO₄)_{2.01}·4.39H₂O. The mineral occurs as a surface efflorescence on Ni-rich sulfide ore in both localities. Nickelblödite is light green and transparent, and occurs as tabular crystallites up to 150 μm in diameter. The Kambalda material is biaxial negative with 2*V* = 60–70°, α 1.513, β (calc) 1.518, γ 1.520. *G* 2.43, indentation hardness VHN 139. The Carr Boyd material has lower indices and hardness. Strongest lines in the powder pattern (Kambalda sample) are 4.466 (7), 4.193 (7), 3.720 (6), 3.223 (10), 3.190 (8), 2.589 (6). Dimensions of the monoclinic cell are: *a* 10.87, *b* 8.07, *c* 5.46 Å, $\beta = 100.72^\circ$. A.P.

Note. The I.M.A. Commission approved the name with the spelling nickelbloedite. M.F.

Palladseite*

R. J. Davis, A. M. Clark and A. J. Criddle (1977) Palladseite, a new mineral from Itabira, Minas Gerais, Brazil. *Mineral. Mag.*, 41, 123.

Palladseite, Pd₁₇Se₁₆, occurs sparingly in the residual concentrates from gold washing, associated with arsenopalladinite, isomertieite, and atheneite. Individual grains are up to 0.5 mm in size. Electron probe analysis gave Pd 55.77, Cu 3.99, Hg 1.66, Se 38.59, sum 100.01 percent. Palladseite crystallizes in the space group *Pm3̄m* with *a* 10.635, *Z* = 2, *G* (calc) 8.15. For synthetic Pd₁₇Se₁₆ *a* = 10.606. In reflected light palladseite is isotropic. It is white in air and in plane polarized light, and a very light gray in oil. The VHN at one Newton is 414, range 390–437. A.P.

Perloffite*

A. R. KAMPF (1977) A new mineral: perloffite, the Fe³⁺ analogue of bjarebyite. *Mineral. Rec.*, 8, 112–114.

Microprobe analyses by A. J. Irving on 11 points over 3 crystals gave Ba 17.6, Ca 1.1, Mg 0.39, Mn 11.1, Fe 18.7, Al 0.15, and P 13.3 (presumably wt. %, but this is not stated). This is calculated to (Ba_{0.99}Ca_{0.09}) (Mn_{1.41}Fe_{0.37}Mg_{0.11}Ca_{0.11})(Fe³⁺_{1.98}Al_{0.04})(OH)₃(PO₄)₃, or Ba(Mn,Fe)₂Fe³⁺(OH)₃(PO₄)₃, the Fe³⁺ analogue of bjarebyite [*Am. Mineral.*, 59, 873 (1974)]. The mineral is dissolved slowly by cold 1:1 HCl.

Perloffite is monoclinic, space group *P2₁/m*, *a* 9.223, *b* 12.422, *c* 4.995 Å, β 100.39°, *Z* = 2, *G* (calc) 3.996. The strongest X-ray lines (50 given) are 4.689 (38)(101), 4.569 (39)(011), 3.166 (100)(031, 221), 3.104 (53)(131), 3.058 (35)(230), 2.979(60)(211), 2.887 (40)(131), 2.742 (43)(311).

The mineral is dark brown to greenish-brown in small crystals to black in larger ones, streak and powder greenish-yellow, luster vitreous to subadamantine. *H* ~ 5, cleavage {100} perfect. Crystals forms *c* {001}, *g* {101}, *t* {021}, *x* {131}, giving spear-shaped crystals up to 1 mm. Optically biaxial, negative, α 1.793, β 1.803, γ 1.808, 2*V* = 70–80°, *r* < *v* strong; pleochroic with *Y* light greenish-brown, *X* and *Z* dark greenish-brown, *X* = *b*, *Y* Δ *c* ~ 42°.

The mineral occurs at the Big Chief pegmatite, Glendale, S. Dakota, as crystals perched on ludlamite, hureaultite, and siderite in vugs in ludlamite formed by hydration of triphylite.

The name is for the well-known American amateur mineralogist, Louis Perloff, of Tryon, N. Carolina.

Discussion

As with bjarebyite, better chemical data are highly desirable, including determination of H₂O, FeO, and Fe₂O₃, DTA and infrared study. It is important that *range* of composition as well as average composition be given for microprobe analyses. M.F.

Seinäjokite*

N. N. Mozgova, Yu. S. Borodaev, N. A. Ozerova, V. Paakonon, O. L. Sveshnikova, V. S. Balitskii and B. A. Dorogovin (1976) Seinäjokite, (Fe_{0.8}Ni_{0.2})(Sb_{1.7}As_{0.3}), and antimonian westerveldite from Seinäjoki, Finland. *Zap. Vses. Mineral. Obshch.*, 105, 617–630 (in Russian).

Electron microprobe analyses (standards—pure metals, galena for Pb and S, synthetic GaAs for As) gave (range and average of 6 analyses): Fe 14.7–16.0, 15.4; Ni 3.4–5.4, 4.0; Co 0.3–0.6, 0.6; Sb 71.6–75.4, 73.5; As 5.7–7.8, 6.9; Te 1.0–1.6, 1.2; sum 100.6–102.5, 101.6 percent, corresponding to (Fe_{0.78}Ni_{0.18}Co_{0.08})

(Sb_{1.71}As_{0.26}Te_{0.03}) or FeSb₂. X-ray study (Cu radiation) showed strongest lines (15 given) 2.81 (10)(012, 110); 2.59 (9)(111); 2.03 (8)(121, 013); 1.790 (6)(103, 122). This is calculated to an orthorhombic cell with a 3.19 ± 0.001, b 5.81 ± 0.01, c 6.49 ± .015 Å. With $Z = 2$, G (calc) = 7.938. Under the microscope in reflected light the mineral is light gray with a rose tint. The mineral polishes well. Reflectances are given at 16 wave lengths from 440 to 740 nm; the curve passes through a flat minimum (60.8%) at 520–580 nm; 460, 62.4; 540, 60.8; 580, 61.0; 640, 62.7; 740, 67.1 percent. Microhardness 251–380, av. 332 kg/sq mm (9 measurements).

The mineral occurs in the antimony ore deposit near Seinäjoki, central Finland; the ore is mainly native antimony. Antimony near the contact with vein minerals contained inclusions of seinäjokite, antimonian westerveldite, breithauptite, altaite, and an undetermined telluride.

The name is for the locality. Type material is in the Mineralogical Museum, Academy of Science, USSR, Moscow. M.F.

Stillwaterite*

L. J. CABRI, J. H. G. LAFLAMME, J. M. STEWART, J. F. ROWLAND AND T. T. CHEN (1975) New data on some palladium arsenides and antimonides. *Can. Mineral.*, 13, 321–335.

In polished section, in air, the mineral is light creamy gray, shows no birefractance, and is weakly anisotropic with color effects from dark gray to brownish gray. Under oil immersion, the anisotropy is distinct with brownish-black colors and a blue to yellow-brown tinge. Reflectance measurements (mean of four grains) gave: 51.6 and 52.7 percent at 470 nm, 52.5 and 53.2 percent at 546 nm, 53.1 and 53.7 percent at 589 nm, and 54.4 and 55.0 percent at 650 nm. The VHN₃₀ measured for seven indentations on two grains is 384 (360 to 416).

Electron microprobe analyses were obtained on thirteen grains. The analysis for one of the type specimens (ROM No. M33559) is: Pd 79.2; As 20.7; Sb, Te, and Sn sought but not detected; total 99.9 weight percent. This gives a formula of Pd_{8.09}As_{3.00}. Another grain gives: Pd 78.2, Pt 0.08, As 17.3, Sb 0.7, Te 1.1, Sn 3.0, Bi 1.3, total 101.7 weight percent. The formula derived from this analysis is Pd_{7.95}Pt_{0.00}(As_{2.50}Sb_{0.06}Te_{0.10}Sn_{0.27}Bi_{0.07}). The ideal formula is Pd₈(As,Sb,Te,Sn,Bi)₃.

Single-crystal X-ray study showed that stillwaterite is hexagonal with space group $P3$ or $P\bar{3}$. The unit-cell parameters determined from a Gandolfi film are: $a = 7.399(4)$ and $c = 10.311(15)$ Å. The unit cell contains 3[Pd₈As₃]. The measured density of synthetic Pd₈As₃ is 10.4 g/cm³. The calculated densities for stillwaterite and synthetic Pd₈As₃ are, respectively, 10.96 g/cm³ and 10.88 g/cm³. The strongest lines (in A) in the Gandolfi patterns are: 2.700(3)(022), 2.355(8)(121), 2.115(10)(114), 1.991(3B)(123), 1.351(5)(233), and 0.8858(4)(165).

The mineral occurs as small anhedral grains (40 × 75 to 120 × 265 microns) associated with gold, other palladium arsenides, and silicates in the Banded and Upper zones of the Stillwater Complex, Montana. The mineral is named after the Stillwater Complex. Type material is preserved at the Royal Ontario Museum, Toronto, and at the Smithsonian Institution, Washington. J.A.M.

Svetlozarite*

M. N. MALEEV (1976) Svetlozarite, a new high-silica zeolite *Zap. Vses. Mineral. Obshch.*, 105, 449–453 (in Russian).

Analysis by L. Ivchinova on 0.95g of selected material gave SiO₂ 69.58, TiO₂ trace, Al₂O₃ 10.26, Fe₂O₃ 0.67, FeO none, MgO 0.30,

CaO 3.91, Na₂O 0.85, K₂O 3.00, H₂O[±] 10.94, sum 99.51 percent. Spectrographic analysis showed Ba 0.1, Sr 0.01 percent, and traces of Cu, Ti, Mn. The analysis corresponding to the formula (Ca_{2.82}K_{2.58}Na_{1.11})(Al_{1.78}Fe_{0.09}Mg_{0.08})(Si_{11.71}Al_{0.26})O_{27.84}·6.14 H₂O, or (Ca,K₂,Na₂)Al₂(Si,Al)₁₂O₂₈·6H₂O. The DTA curve shows a broad endothermal effect, with max. at 160°. The water is lost continuously to 900°, total loss of weight to 900° = 11.23 percent. At 300°, it loses 7.55 percent which is regained in 5 hours in moist air. The mineral is not affected by concentrated HCl, HNO₃, or H₂SO₄, but concentrated HF decomposes it, leaving a gelatinous residue.

X-ray study shows the mineral to be orthorhombic, a 19.482, b 20.963, c 7.554 Å, $Z = 4$, G calc. 2.174, meas. 2.166, 2.167. The strongest X-ray lines (25 given) are 9.74 (23)(200), 9.24 (25)(120), 8.83 (50)(210), 4.87 (100)(400), 3.777 (24)(002), 3.440 (39)(160), 2.961(25)(170).

The mineral is colorless to snow-white, luster vitreous to pearly on cleavages. Three perfect cleavages at right angles are visible in electron microscope photographs. H-4. Optically biaxial, positive, n_s (Na) α 1.481, β 1.482, γ 1.483, 2V-23°, dispersion $r > v$, distinct, elongation negative.

The mineral occurs as spherulites of diameter 5–15 mm. in veinlets of chalcedony in brecciated andesites, west of Zvezdel, eastern Rhodopes, Bulgaria. Associated minerals are ferrierite and clinoptilolite (earlier formed) and mordenite (formed simultaneously).

The name is for Svetlozar Ionchev Botev (1940–1971), Bulgarian mineralogist. Type material is in the Mineralogical Museum, University of Sofia. M.F.

Tveitite*

SVEINUNG BERGSTØL, B. B. JENSEN AND HENRICH NEUMANN (1977) Tveitite, a new calcium yttrium fluoride. *Lithos*, 10, 81–87.

Analysis of a sample purified by heavy-liquid and magnetic separations gave Ca 27.4, Y 22.2, rare earths 8.06, U 0.05, Mn 0.02, Fe 0.08, F 41.3, sum 99.11 percent. The rare earths consisted of La 1.28, Ce 3.86, Pr 0.56, Nd 0.90, Sm 0.12, Eu 0.04, Gd 0.12, Tb 0.03, Dy 0.26, Ho 0.05, Er 0.17, Tm 0.13, Yb 0.35, Lu 0.19 percent. A microprobe analysis gave Ca 28.0, Y 22.7, Ce 4.1, F 46.3 percent. This leads to a formula Ca_{1-x}(Y,RE)_xF_{2+x}, where x is ~0.3.

X-ray powder data (27 lines) are indexed on a pseudocubic monoclinic cell with a' 3.924, b' 3.893, c' 5.525 Å, β 90.26°, but to index all the observed lines requires a superlattice 96 times the monoclinic unit cell. Further work is needed. The strongest lines are 3.184 (10)(011), 2.764 (5)(110,002), 1.963 (5)(200), 1.949 (7)(020), 1.664 (6)(013,121), 1.265 (8)(031,123). DTA study shows a sharp endothermic break at 670° (inversion); samples heated to 800°C for 2 hours gave a fluorite pattern, a 5.528 Å, and the material does not invert to tveitite on cooling.

The mineral is white to pale yellow, luster greasy. Fluorescence in shortwave UV faint yellow-orange. Optically biaxial, neg., α 1.476 β 1.479, γ 1.481, 2V 34°. Shows complex polysynthetic twinning.

The mineral occurs in a pegmatite dike at Høydalen, Telemark, S. Norway, associated with quartz, amazonite, microcline, muscovite, beryl, and monazite. Tveitite contains inclusion of a mineral of the gadolinite group.

The name (pronounced to rhyme with late) is for John Tveit, who found it in his quarry. Type material (one sample 10×10×5cm) is at the Geological Museum, University of Oslo, Norway. M.F.

Vertumnite*

E. PASSAGLIA AND E. GALLI (1977) Vertumnite, a new natural silicate. *Tschermak's Mineralog. Petrogn. Mitt.*, 24, 57-66.

Chemical analysis gave: SiO₂ 21.67, P₂O₅ 0.20, Al₂O₃ 24.83, CaO 22.56, SrO 0.64, BaO 0.16, Na₂O 0.06, K₂O 0.10, H₂O⁻ 5.96, H₂O⁺ 23.74, sum 99.92 percent. The formula may be idealized to Ca₄Al₄Si₄O₆(OH)₂₄·3H₂O. Vertumnite is monoclinic but pseudo-hexagonal, and is described in the unconventional "first setting" with a 5.744(5), b 5.766(5), c 25.12(1) Å, $\gamma = 119.72(5)^\circ$; the diffraction symbol is $P2_1/*$, $Z = 1$, G (meas) 2.15(4), (calc) 2.15. No discernible cleavage, $H=5$, very brittle, fracture conchoidal; soluble in cold HCl. Colorless, vitreous, α 1.531(1), β 1.535(1), γ 1.541(2), biaxial, negative, $2V = 62(5)^\circ$, $X = c$, $Z \Delta b = 16^\circ$ in the obtuse angle, no discernible dispersion. The five strongest lines of the powder pattern in order of decreasing spacings are: 12.51(70)(002); 6.275 (65)(004); 4.275 (16)(013, 103, $\bar{1}$ 13); 4.187 (100)(006); 2.873 (17)($\bar{1}$ 10, $\bar{1}$ 20, $\bar{2}$ 10).

Vertumnite occurs as transparent, flattened, hexagonal prisms, up to 4 mm thick, resting on tobermorite in a subspherical geode in phonolite at Campomorto, Montalto di Castro, Viterbo, Italy. Vertumnite has obvious similarity of cell dimensions and the strongest lines of the diffraction pattern to "hexagonal hydrated gehlenite" and the recently described mineral strätlingite, though its Si/Al ratio of unity is double that of these related phases.

The name is in honor of the mighty Etruscan god *Vertumnus*, venerated by the ancient Etruscan people who lived in the region where vertumnite was found. A.P.

Unnamed arsenate-sulfate of Pb, Fe, Cu

KURT WALENTA (1976) Tsumcorite from the Michael Mine, Weiler near Lahr, Black Forest. *Aufschluss*, 27, 373-379 (in German).

The mineral was found on the dump of the lead mine at Mola, Tarragona Province, Spain, as yellow to greenish-yellow earthy crusts on corroded tetrahedrite. Qualitative tests shows it to be an arsenate-sulfate of Pb, Fe, and Cu. The ratio Cu/Fe appears to be variable; green varieties contain more Cu. It has $ns \alpha < 1.91$, $\gamma > 1.91$. The strongest X-ray lines (29 given) are 4.76 (8), 4.53 (7), 3.28 (8), 3.16 (8), 2.96 (9), 2.86 (7), 2.51 (10). M.F.

Unnamed Pd₅As₂

L. J. CABRI, J. H. G. LAFLAMME, J. M. STEWART, J. F. ROWLAND AND T. T. CHEN (1975) New data on some palladium arsenides and antimonides. *Can. Mineral.*, 13, 321-335.

In reflected light the mineral is pale cream to cream in air and in oil. No birefractance was observed in air, but varied from nil to very weak in oil. The anisotropism in air varied from distinct (or moderate) to strong, with colors varying from gray (or dull gray) to black (or brownish-black). The anisotropism and colors were similar under oil immersion. The reflectance and birefractance are increased in grains which contain Au substituting for Pd. The mineral is more reflectant and anisotropic than stillwaterite.

Electron microprobe analyses of five grains gave: Pd 70.1, 79.0, 68.4, 68.6, 68.0; Pt 0.24, n.d., n.d., n.d.; Au 6.8, n.d., 7.4, 7.8,

6.9; Hg 2.7, n.d., 2.3, 1.3, 2.5; Cu 0.21, n.d., 0.13, 0.09, n.d.; As 21.2, 22.2, 21.0, 20.8, 20.6; Sn -, -, 0.31, 0.26, n.d.; Sb -, -, n.d., n.d., n.d.; Te n.d., n.d., n.d., n.d.; Bi -, -, -, n.d., -; total 101.25, 101.2, 99.54, 98.85, and 98.00 weight percent. These data give formulae which are very close to (Pd,Au,Hg,Cu,Pt)₅(As,Sn)₂. The mineral is orthorhombic (space group? J.A.M.) with $a = 11.261(4)$, $b = 3.857(1)$, and $c = 11.345(5)$ Å. Strongest lines in the Gandolfi pattern (in A for Ni-filtered Cu radiation) are: 3.066(10)(211), 2.778(6)(212), 2.433(5)(312), 2.119(8)(214), 1.947(9)(510), and 0.7770(9)(745).

The mineral occurs with palladoarsenide, sperrylite, and chalcopyrite; with stillwaterite; and with an "unknown (Pd,Cu,As) mineral" in the Stillwater Complex, Montana.

The authors feel that the mineral should not be named until type arsenopalladinite has been reexamined. J.A.M.

Unnamed Pd₅Sb₃

L. J. CABRI *et al.* (1975) *ibid.*

A single grain, 190 × 300 microns, found in a sample labeled "Copper Cliff Concentrate" from the Sudbury area, gave electron microprobe results identical to those given by synthetic Pd₅Sb₃ (data not given. J.A.M.). The mineral is metallic with a pinkish cast. In polished section, it is pale cream to white in air and in oil immersion. No birefractance was observed. The mineral is moderately anisotropic (reddish-brown to light gray) in air. Under oil immersion the anisotropism is slightly stronger with the same colors. Reflectance values (mean of four measurements) are: 47.7 and 52.2 percent at 470 nm; 49.7 and 53.5 percent at 546 nm; 50.9 and 54.6 percent at 489 nm; and 52.6 and 56.4 percent at 650 nm. Ten micro-indentation hardness measurements were made on synthetic Pd₅Sb₃ and gave VHN₅₀ = 516 (501-545). Data from a Gandolfi pattern were indexed as hexagonal [$a = 7.565(1)$, c 43.207(3)Å] with a rhombohedral lattice. The strongest lines of the Gandolfi pattern (in A for Ni-filtered Cu radiation) are: 2.369(4)(125), 2.293(8)(11.15), 2.238(7B)(20.14), 2.025(4B)(11.18), 1.258(4B)(40.22), and 1.205(4)(30.30). The calculated density is 11.32 g/cm³ based on $Z = 12$.

The authors have not named the mineral because its relationship to mertieite II and synthetic Pd₅Sb₃ is not clear. J.A.M.

Unknown (Pd,Cu,As) mineral

L. J. CABRI *et al.* (1975) *ibid.*

Several grains of this mineral were found and were nearly always associated with the unnamed Pd₅As₂ mineral. The mineral appears to be an alteration product or a secondary mineral and has a pitted or intergrowth texture. It also occurs as a banded intergrowth with the unnamed Pd₅As₂ mineral. The color is dull gray under reflected light. The mineral tarnishes with time and exposure to air. Although the results of electron microprobe analysis were considered unreliable, it was determined that Pd was the major element with Cu and As in minor and nearly equal quantities by weight. (The mineral should be referred to as an "unidentified Pd-Cu-As mineral" J.A.M.) J.A.M.