NEW MINERAL NAMES*

John L. Jambor

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

Jacek Puziewicz

Institute of Geological Sciences, University of Wroclaw, Cybulskiego 30, 50–205 Wroclaw, Poland

Arupite*

V.F. Buchwald (1990) A new mineral, arupite, $Ni_3(PO_4)_2 \cdot 8H_2O$, the nickel analogue of vivianite. Neues Jahrb. Mineral. Mon., 76–80.

Electron-microprobe analysis gave NiO 40.18, CoO 0.39, FeO 4.53, P_2O_5 27.60, H_2O (by difference) 27.30, sum 100 wt%, corresponding to $(Ni_{2.78}Fe_{0.33}Co_{0.03})_{\Sigma3.14}$ $(PO_4)_{2.01}O_{0.12} \cdot 7.84H_2O$, ideally $Ni_3(PO_4)_2 \cdot 8H_2O$, which is the nickel analogue of vivianite. The mineral occurs as earthy aggregates up to 2 mm in diameter; sky-blue to turqoise-blue color, earthy luster, translucent, H = 1.5–2, nonfluorescent, D_{calc} = 2.85 g/cm^3 with Z = 2. Individual grains are short prisms, 2–5 μm long. Optically biaxial, α' = 1.632(5), γ' = 1.680(5), X = blue, Z = colorless. By analogy to vivianite, monoclinic, space group $I2/m$, a = 9.889(15), b = 13.225(11), c = 4.645(4) Å, β = 102.41(11)°. Strongest lines of the X-ray powder pattern, which is similar to those of vivianite and synthetic $Ni_3(PO_4)_2 \cdot 8H_2O$, are 7.878(36,110), 6.624(100,020), 4.818(61,200), 3.805(50,101), 2.922(72,$\bar{3}$01), and 2.672(46,$\bar{3}$21).

The mineral occurs in the Santa Catharina Ni-rich Fe meteorite, which was severely weathered when found in 1875 on the coast of southern Brazil. Associated secondary Ni minerals are honessite and reevesite. The new name is for Hans Arup (1928–), Director of the Danish Corrosion Center. Type material is in the Division of Meteorites, Smithsonian Institution, Washington, D.C. **J.L.J.**

Bernardite*

J. Pašava, F. Pertlik, E.F. Stumpfl, J. Zemann (1989) Bernardite, a new thallium arsenic sulphosalt from Allchar, Macedonia, with a determination of the crystal structure. Mineral. Mag., 53, 531–538.

Six electon-microprobe analyses of a grain gave Tl 22.0–23.4, As 35.2–43.7, Sb 0.1–10.4, S 29.8–32.6, corresponding to $Tl(As_{1-x}Sb_x)_5S_8$ and $Tl(As_{1-x})_5S_9$, with $0.0 \leq x \leq 0.15$; the ideal formula is $TlAs_5S_8$, based on X-ray crystal-structural study. The mineral occurs with realgar and orpiment as black, thick-tabular crystals that are typically ≤1 mm, but up to 4 × 3 × 1.5 mm; faces are dull,

partly corroded and striated; {100}, {012}, {210} prominent, {201}, {$\bar{2}$01}, and {010} subordinate. No cleavage, sub-conchoidal to uneven fracture, H = 2, red streak, D_{meas} = 4.5(1), D_{calc} = 4.11 g/cm^3 with Z = 4. Maximum and minimum reflectance values at 589 nm for a single grain in arbitrary orientation range from 23.8 to 24.7% in air, and 10.2 to 11.6% in oil. X-ray study indicated monoclinic symmetry, space group $P2_1/c$, a = 15.647(4), b = 8.038(3), c = 10.750(3) Å, β = 91.27(3)°. Strongest lines of the calculated powder-diffraction pattern are 4.46(65,012), 4.28(74,112), 4.09(61,31$\bar{1}$), 3.78(63,021,30$\bar{2}$), 3.72(55,302), 3.42(54,31$\bar{2}$), 3.07-(65,32$\bar{1}$), 3.06(100,321), and 2.68(59,004,023).

The mineral occurs in the well-known, late Tertiary, thallium-mineral-bearing Allchar deposit in southern Macedonia, Yugoslavia. The new name is for J.H. Bernard of the Geological Survey of Czechoslovakia, who first recognized the mineral. Type material is at the Národni Museum in Prague, Czechoslovakia, at the Naturhistorisches Museum in Vienna, Austria, and at the Institut für Mineralogie und Kristallographie der Universität Vienna, Austria. **J.L.J.**

Florensovite*

L.Z. Reznitskii, E.V. Sklyarov, L.F. Piskunova, Z.F. Ushchapovskaya (1989) Florensovite $Cu(Cr_{1.5}Sb_{0.5})S_4$—A new sulfospinel from Pribaikalya. Zapiski Vses. Mineralog. Obsch., 118(1), 57–65 (in Russian).

Microprobe analysis (39 given) gave: Cu 18.80, Zn 0.75, Cr 24.24, Sb 19.17, V 0.02, S 38.45, sum 100.43 wt%, corresponding to $Cu_{0.972}Zn_{0.038}Cr_{1.531}Sb_{0.517}V_{0.001}S_{3.940}$. By analogy with synthetic compounds it is suggested that copper is monovalent, chromium is trivalent, and antimony is pentavalent. The mineral forms a continuous solid solution with kalininite ($ZnCr_2S_4$), with the Cu:Sb ratio constant at 2:1. Grains are typically 50–60 μm in diameter, and the maximum size is 150 × 200 μm. Contacts between Cu-rich kalininite and Cu-poor florensovite are gradational; there are also sharp contacts between kalininite containing 0.7 atoms of Zn per formula unit (pfu) and florensovite containing 0.7–0.8 atoms Cu pfu. Color black, adamantine to metallic luster, strongly magnetic, H = 477–541 kg/mm^2, average 511 (Mohs 5) with a 50-g load for grains of composition $Cu_{0.80-85}Zn_{0.15-0.20}$; D_{calc} = 4.28 g/cm^3 with Z = 8. Insoluble in dilute and concentrated HCl. Optically pale creamy in reflected light, iso-

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

tropic, no internal reflections. Reflectance measurements for a grain with $Cu_{0.85}Zn_{0.15}$ (nm, R %): 440,23.2; 460,24.5; 480,25.7; 500,26.4; 520,26.5; 540,26.5; 560,26.8; 580,27.0; 600,27.4; 620,27.5; 640,27.1; 660,26.6; 680,26.3; 700,26.2. X-ray powder-diffraction study showed the mineral to be cubic, space group $Fd3m$ (by analogy with synthetic $CuCr_2S_4$), $a = 10.005(6)$ Å; strongest lines (20 given) are: 3.01(100,311), 2.50(80,400), 1.923(80,511,333), 1.768(100,440), 1.021(80,844).

The mineral was found in Cr- and V-rich metasedimentary rocks of the Slyudyanka granulite complex, south of Lake Baikal, Siberia, USSR, associated with diopside, calcite, quartz (main rock-forming minerals), tremolite, uvarovite-goldmanite garnet, karelianite-eskolaite, pyrite, ilmenite, pyrrhotite, magnesiochromite, chalcopyrite, franklinite, barite, apatite, zircon, and other minerals. Sulfospinels occur as irregular inclusions, up to 0.8 mm in size, in pyroxene and garnet, or as overgrowths on eskolaite-karelianite. Aggregates of the sulfospinels are slaglike, brittle, and crumble under a needle. The new name is for Nikolai Aleksandrovich Florensov, organizer of geological academic studies in Siberia. Type material is at the Central Siberian Geological Museum, Novosibirsk, USSR. **J.P.**

Ilbaite

A. Motiu, L. Suciu (1987) Geochemical and structural study of the pulverulent white masses that occur in the ore body of the Ilba lode. Studia Univ. Babes-Bolyai, Geol.-Geog., 32(2), 95–97 (in English).

A highly fractured zone in the Ilba mine, 30 km from Baia-Mare, Marumres County, northwestern Rumania, contains white pulverulent masses for which wet-chemical analysis gave SiO_2 45.80, Al_2O_3 28.86, TiO_2 0.14, Fe_2O_3 0.62, CaO 1.29, MgO 0.32, Na_2O 0.01, K_2O 0.09, H_2O 22.64 wt% [sum 99.77]. The main components correspond to $3.37Al_2O_3 \cdot 2.12SiO_2 \cdot 4.3H_2O$. Spectrographic analysis gave (ppm) Zn 850, Cu 713, Pb 392, S 180, Cr 105, P 31, Cl 29. An infrared spectrum shows well-defined absorption bands interpreted as indicating a transformation to halloysite. The DTA curve has a large endothermal peak at 141 °C, and the X-ray diffractogram shows only weak, broad peaks at 4.693 and 3.420 Å. The mineral is considered to be a new member of the allophane group, characterized by its white color, titanium content, and the presence of Pb, Cr, and Cl. The new name is for the locality.

Discussion. An unapproved and unnecessary name. **J.L.J.**

Kamchatkite*

L.P. Vergasova, S.K. Filatov, E.K. Seraphimova, T.V. Varaksina (1988) Kamachatkite $KCu_3OCl(SO_4)_2$—A new mineral from volcanic sublimates. Zapiski Vses. Mineralog. Obsch., 117(4), 459–461 (in Russian).

A combination of flame photometry, atomic-absorption spectroscopy, and volume-weight analyses gave CuO 48.62, PbO 0.17, ZnO 0.62, Na_2O 0.20, K_2O 10.48, Cl 6.20, SO_3 33.96, H_2O^- 1.75, H_2O^+ 0.00, insoluble residue 0.20, O $\equiv$ Cl 1.40, sum 100.80 wt%. The H_2O was assumed to be absorbed, and the deficiency of anions relative to cations (Σ A = 1.02, Σ K = 1.47) was assumed to be due to additional O anions by analogy with melanothallite and piypite. Calculated O = 3.56 wt%, and the formula is $(K_{1.06}Na_{0.03})_{\Sigma 1.09}(Cu_{2.92}Zn_{0.04})_{\Sigma 2.96}O_{1.04}Cl_{0.84}$-$(SO_4)_{2.03}$. Soluble in H_2O and in weak acid (1:20) solutions. Decomposes in air in a few weeks because of hydration. Crystals are rodlike, greenish-yellowish brown, elongate [001] and up to 3 mm long, rectangular or rhombic (angle 74.7°, calc. 74.3°) in cross section, up to 0.5 mm wide; well-developed {110} and {100}, poor {110} and {001}. Luster vitreous, streak yellow, H = 3.5, perfect {011} and {100} cleavages, D_{meas} = 3.48, D_{calc} = 3.58 g/cm³ with Z = 4. In transmitted light, transparent, yellow, biaxial positive, α = 1.695, β = 1.718, γ = 1.759 ($\pm$0.002), $2V_{calc}$ = 75°; elongation negative, extinction straight relative to elongation, $X = c$, $Y = a$, $Z = b$. No pleochroism, no dispersion. X-ray single-crystal and powder study showed the mineral to be orthorhombic, space group $Pnam$ or $Pna2_1$, $a = 9.741(5)$, $b = 12.858(6)$, $c = 7.001(3)$ Å. The strongest lines in the powder pattern are 7.76(100,110), 3.501(65,002), 3.217(30,040), 2.682(30,240), and 2.591(41,330).

The mineral was found in the area of the Great Tolbachik Fissure Eruption, Kamchatka Peninsula, USSR, where it occurs as a fumarolic product intergrown with copper, potassium, and sodium sulfates, and associated with ponomarevite, hematite, and klyuchevskite. Specimens were collected from sublimates that formed at 120–240 °C. The new name is for the locality. Type material is at the Mining Museum of the Leningrad Mining Institute, USSR. **J.P.**

Klyuchevskite*

L.P. Vergasova, S.K. Filatov, M.G. Gorskaya, V.V. Ananev, A.S. Sharov (1989) Klyuchevskite $K_3Cu_3Fe^{3+}O_2(SO_4)_4$—A new mineral from volcanic sublimates. Zapiski Vses. Mineralog. Obsch., 118(1), 65–69 (in Russian).

Microprobe analysis (average of 7) gave Na_2O 0.01, K_2O 18.95, Fe_2O_3 4.21, CuO 32.50, ZnO 0.04, CaO 0.03, SO_3 41.62, PbO 0.29, Cl 0.01, total 97.63 wt%, corresponding to $K_{3.09}Cu_{3.00}(Fe_{0.46}Cu_{0.15})_{\Sigma 0.61}(SO_4)_{4.00}$. The presence of Fe^{3+} was demonstrated by Mössbauer spectroscopy, and the absence of Cu^+ by wet-chemical analysis. Readily soluble in H_2O and weak acid (1:20). Hydrates in air in one week. Stable in air up to 625 °C. Crystals, which occur as unorientated aggregates, are dark green to olive green, acicular, elongate [010], up to 0.1 mm long and not thicker than 0.01 mm. Luster semimetallic, streak light green, H = 167 kg/mm² (3-g load), perfect {h0l}

cleavage, $D_{meas} = 3.00-3.15$, $D_{calc} = 3.02(1)$ g/cm³ with Z = 4. In transmitted light, transparent, pleochroic, X = olive, Y = green, Z = dark olive. Biaxial positive, parallel extinction, $\alpha = 1.549(1)$, $\beta = 1.550(1)$, $\gamma = 1.680(1)$, $2V_{calc}$ = 11°, $Y = b$. Single-crystal X-ray study showed the mineral to be monoclinic, space group $I2/m$, Im, or $I2$. Powder-diffraction study gave $a = 18.412(7)$, $b = 4.944(2)$, $c = 18.640(9)$ Å, $\beta = 101.5(4)°$; strongest lines (35 given) are 9.17(95,002), 9.03(100,200), 7.20(35,20$\bar{2}$), 3.762(55,402), and 3.409(28,501).

The mineral, a fumarolic product at the Great Tolbachik Fissure Eruption, Kamchatka, USSR, occurs in cavities and fissures in massive sublimates composed of kamchatkite, ponomarevite, and hematite. The new name is for the locality. Type material is at the Mining Museum of the Leningrad Mining Institute, Leningrad, USSR. **J.P.**

Moschelite*

E.R. Krupp, G. Nottes, U. Heidtke (1989) Moschelite (Hg_2J_2): A new mercury mineral from Landsberg-Obermoschel. Neues Jahrb. Mineral. Mon., 524–526.

Chemical analysis gave Hg 61.02, I 38.55, sum 99.57 wt%; ideal Hg_2I_2 contains Hg 61.25, I 38.75 wt%. The mineral occurs as crusts and plates; grain size is about 0.1 mm, and crystals vary from tabular to short prismatic, possibly showing {110} and {001}. Citrus-yellow color, darkening to olive green on exposure to light; brown streak, adamantine luster, translucent at grain edges, H = 1–2, sectile, imperfect cleavage, conchoidal fracture, nonfluorescent, $D_{calc} = 7.75$ g/cm³ [$Z = 2$]. By analogy to calomel (Hg_2Cl_2) the mineral is tetragonal, space group $I4/mmm$, $a = 4.920(3)$, $c = 11.600(9)$ Å; strongest lines (11 listed) of the X-ray powder pattern are 3.483(100,110), 2.896(60,004), 2.231(90,114), and 2.099(60,105).

The mineral occurs in a sandstone in association with cinnabar and native Hg in dump material from an abandoned mine among those at Moschel-Landsberg near Obermoschel, Federal Republic of Germany. Small quantities of iodine apparently were derived from underlying coal seams in the mine. The new name is for the locality. The mineral is the iodine analogue of calomel, which also occurs in the deposit.

Discussion. A repository for type material is not given. **J.L.J.**

Pararobertsite*

A.C Roberts, B.D. Sturman, P.J. Dunn, W.L. Roberts (1989) Pararobertsite, $Ca_2Mn_3^{3+}(PO_4)_3O_2\cdot 3H_2O$, a new mineral species from the Tip Top pegmatite, South Dakota, and its relationship to robertsite. Can. Mineral., 27, 451–455.

Electron-microprobe analysis of red, transparent plates and clusters of plates on whitlockite gave CaO 18.3, Mn_2O_3 38.0, Fe_2O_3 0.1, P_2O_5 35.2, H_2O (by difference) 8.4,

sum 100 wt%, corresponding to $Ca_{8.05}(Mn_{11.87}^{3+}Fe_{0.03}^{3+})_{\Sigma 11.90}(PO_4)_{12.24}O_{7.54}\cdot 11.5H_2O$, ideally $Ca_2Mn_3^{3+}(PO_4)_3O_2\cdot 3H_2O$. The plates are up to 0.2 mm in longest dimension, ≤0.02 mm thick, tabular {100}, vitreous luster, brownish red streak, perfect {100} cleavage, brittle, soft, nonfluorescent, $D_{meas} = 3.22(4)$, $D_{calc} = 3.22$ for the empirical formula, and 3.21 g/cm³ for the idealized formula. Optically biaxial negative, $\alpha = 1.79(1)$, $\beta = 1.81(1)$, $\gamma = 1.83(1)$, $2V_{meas} = 84(2)°$, $Y = b$, $Z \wedge c = 4(2)°$, absorption $Z = Y$ (reddish brown), X = yellowish brown. X-ray single-crystal study indicated monoclinic symmetry, space group $P2_1/c$, $a = 8.825(3)$, $b = 13.258(4)$, $c = 11.087(3)$ Å, $\beta = 101.19(4)°$ as refined from the powder pattern (114.6-mm Gandolfi camera, Fe radiation) which has strongest lines at 8.69(100,100), 5.66(60,021), 5.44(50,002), 3.179(50,023), 2.884(60,300), 2.834(50,123,042), 2.611(60,142), and 2.163(60,400). There is a pronounced subcell, with $b' = \frac{1}{2}b$.

The mineral occurs on whitlockite that encrusts carbonate-apatite on quartz in secondary seams at the Tip Top pegmatite, Custer, South Dakota. The new name reflects the close relationship to robertsite (hence the unconventional unit-cell setting for pararobertsite). A new analysis of type robertsite gave results in agreement with a formula $Ca_6(H_2O)_6Mn_9^{3+}(PO_4)_9O_6\cdot 3H_2O$. Holotype specimens of pararobertsite are in the Smithsonian Institution, Washington, D.C., and in the Royal Ontario Museum, Toronto, Canada. **J.L.J.**

Sophiite*

L.P. Vergasova, S.K. Filatov, T.F. Semenova, T.M. Filosofova (1989) Sophiite $Zn_2(SeO_3)Cl_2$—A new mineral from volcanic sublimates. Zapiski Vses. Mineralog. Obsch., 118(1), 65–69 (in Russian).

Microprobe analysis (38 determinations) gave ZnO 47.83 (45.90–51.40), SeO_2 34.48 (32.69–36.63), CuO 0.19 (0–0.75), PbO 0.35 (0–0.86), Cl 22.26 (20.44–23.72), O $\equiv$ Cl 5.02 (4.61–5.35), sum 100.09 (98.09–102.00) wt%, corresponding to $(Zn_{1.92}Cu_{0.01}Pb_{0.01})_{\Sigma 1.94}(Se_{1.02}O_{2.94})_{\Sigma 3.96}Cl_{2.06}$. Becomes turbid white, and crystals bend and swell, on exposure to air; decomposition products form radial aggregates. Readily soluble in dilute acids, soluble with difficulty in water. Occurs as well-formed, pseudohexagonal thin-platy to micalike crystals; {010} well-developed, {100} poorer; many crystals are elongate [001]; swallowtail twins on {100}; up to 5 mm long and 0.01–0.10 mm thick. Colorless, transparent, becoming sky blue on long exposure to air. Streak white, luster vitreous to greasy or silky, H = 49 (38–61 kg/mm²; 10-g load). Brittle, perfect {010} and less perfect {201} cleavages, $D_{calc} = 3.64$ g/cm³ with $Z = 8$. Optically biaxial positive, negative elongation, parallel extinction, optic-axis plane (001), $\alpha = 1.709(3)$, $\beta = 1.726(2)$, $\gamma = 1.750(2)$, $2V_{calc} = 81°$, $X = b$, $Y = c$, $Z = a$. X-ray powder and crystal-structural studies showed the mineral to be orthorhombic, space group $Pccn$, $a = 10.251(4)$, $b = 15.223(2)$, $c = 7.666(5)$ Å. The struc-

ture consists of layers parallel to {001}, composed of elongated $Zn(O,Cl)_6$ octahedra, connected with isolated $(SeO_3)^{2-}$ triangles. The layers are connected by $Zn(O,Cl)_5$ pentahedra. The strongest powder-pattern lines are 7.61(100,020), 3.807(23,040), 3.237(6,141), 3.055(8,032), 2.918(12,150), and 2.538(6,060); intensities are affected by preferred orientation owing to the {010} cleavage.

Sophiite occurs at the Great Tolbachik Fissure Eruption, Kamchatka Peninsula, USSR, associated with cottonlike hygroscopic masses of phases containing Zn and Cl, and with tenorite, cotunnite, ponomarevite, halite, sylvite, and native gold. The specimens were collected at temperatures 180–230 °C. The new name is for Sophia Ivanovna Naboko, a leading investigator of the volcanoes of the Kamchatka Peninsula. Type material is at the Mining Museum of the Leningrad Mining Institute, Leningrad, USSR. **J.P.**

Vochtenite*

P.C. Zwaan, C.E.S. Arps, E. de Grave (1989) Vochtenite, $(Fe^{2+},Mg)Fe^{3+}[UO_2/PO_4]_4(OH)\cdot12–13H_2O$, a new uranyl phosphate mineral from Wheal Basset, Redruth, Cornwall, England. Mineral. Mag., 53, 473–478.

Electron-microprobe analysis, H_2O by TGA, and Fe^{2+}/Fe^{3+} by Mössbauer spectroscopy, gave Fe_2O_3 4.04, FeO 3.30, MgO 0.63, UO_3 63.07, P_2O_5 15.65, H_2O 13.37, sum 100.96 wt%, corresponding to $(Fe_{2.48}^{2+}Mg_{0.84}$-$Fe_{2.74}^{3+})_{\Sigma6.06}U_{11.92}P_{11.90}O_{73}\cdot40.15H_2O$, ideally $(Fe^{2+},$ $Mg)Fe^{3+}[UO_2/PO_4]_4(OH)\cdot13H_2O$. It is assumed that zeolitic H_2O is present, and thus the formula is represented better as having $12–13H_2O$. The mineral occurs as brown crystal aggregates of subparallel crystals, each 0.5–1.0 mm and pseudoquadratic in outline from intersection of {001} and {100}; bronze luster, opaque in thick fragments, pale brown streak, H = 2.5, prominent {010} cleavage, soluble in 1:1 HCl, nonfluorescent, D_{meas} = 3.650 (heavy liquids), D_{calc} = 3.663 g/cm³ with Z = 3. Optically biaxial negative, α = 1.575(2), β = 1.589(2), γ = 1.603(2) at 589 nm, $2V_{calc}$ = 89(3)°, weakly pleochroic, $X = b$, $Z \wedge c$ is small. TGA shows H_2O losses in three steps to 200 °C. Guinier-Hägg X-ray powder films ($CuK\alpha_1$ radiation, camera diameter 100 mm) have strongest lines at 9.998(100,020), 4.892(45,002), 3.475(70,311), 3.333(50,060), 2.152-(45,52$\bar{3}$), and 2.111 Å (45,34$\bar{4}$,47$\bar{1}$); the resultant monoclinic cell has a = 12.606, b = 19.990, c = 9.990, β = 102.31°.

The mineral occurs at the Basset mine, southeast of Camborne in Cornwall, England, where chalcopyrite, chalcocite, and cassiterite are the minerals of importance, and bassetite in small amounts is the only primary uranyl phosphate mineral. The new name is for Professor R.F.C. Vochten of the State University of Antwerpen, Belgium. Type material is in the Smithsonian Institution, Washington, D.C. **J.L.J.**

Gold amalgam

V. Atanasov, I. Iordanov, O. Vitov, A.V. Atanasov (1988) Amalgams of gold in some Bulgarian alluvial sands. Godishnik Vissh. Minno-Geol. Inst. Sofia, 34(1), 227–238 (in English).

Forty-four electron-microprobe analyses of gold-bearing grains from several placer sites in Bulgaria include compositions corresponding to the compounds $(Au,Ag)_2Hg$, α-AuAgHg, (Au,Ag)Hg, $(Au,Ag)_3Hg$, and $(Au,Ag)_3Hg_2$. X-ray powder data were obtained for the first three of the phases, and are tabulated for two of them. It is likely that the Hg was derived by contamination from amalgamation procedures used in historical times. **J.L.J.**

Rhenium sulfide

R.H. Mitchell, J.H.G. Laflamme, L.J. Cabri (1989) Rhenium sulphide from the Coldwell complex, northwestern Ontario, Canada. Mineral. Mag., 53, 635–637.

Electron-microprobe analysis of a crystal 7 × 10 μm gave Re 48.95, Mo 14.15, Cu 4.75, Fe 4.15, S 26.85, sum 98.85 wt%, corresponding to $(Re_{18.82}Mo_{10.56}Cu_{5.35}$-$Fe_{5.32})_{\Sigma40.05}S_{59.95}$, ideally $(Re,Mo,Fe,Cu)_2S_3$ or $Re(Mo,$-$Fe,Cu)S_3$. The grain is enclosed in pyrrhotite intergrown with chalcopyrite in pegmatitic facies of a gabbro in the Coldwell alkaline complex, northwestern Ontario. Associated minerals are hollingworthite, hessite, paolovite, michenerite, and clausthalite. **J.L.J.**

Unnamed Bi_3S_5, Bi_3S_4, $BiPb_2S_2$, Bi_9Te_4, Ag_4PbTe_2S, and $Ag_8Bi_3Te_7$

Z.N. Pavlova, P.E. Kotelnikov (1988) Forms of occurrence of silver, bismuth, tellurium, selenium, cobalt and antimony in a copper-gold ore deposit in Kazakhstan. Izvestiya Akad. Nauk Kazak. SSR, Ser. Geol., 1988(2), 13–23 (in Russian).

Bi_2S_5

The minerals occur in Cu-Au ores in Kazakhstan, USSR. Electron-microprobe analysis gave Bi 79.67, S 20.36, sum 99.97 wt%, corresponding to Bi_3S_5. In reflected light, similar to bismuthinite: bright gray with a bluish tint, pleochroic, strongly anisotropic in black and white colors. The mineral occurs in bismuthinite as thin plates, 0.05–0.07 mm, associated with native gold; also as a decomposition product of tsumoite, and as 3-μm rims on it.

Bi_3S_4

Electron-microprobe analysis gave Bi 82.21, Ni 0.65, S 17.37, sum 100.23 wt%, corresponding to $(Bi_{2.90}$-$Ni_{0.08})_{\Sigma2.98}S_{4.00}$. Optically similar to bismuthinite; occurs as intergrowths in gersdorffite.

$BiPb_2S_2$

Electron-microprobe analysis gave Bi 33.38, Pb 59.44, Te 0.45, S 9.12, sum 102.39 wt%, corresponding to $BiPb_2S_2$. Gray in reflected light, no anisotropy or bireflectance observed. The mineral occurs as platy intergrowths up to 1 μm in thickness in joseite and native bismuth.

Bi_9Te_4

Electron-microprobe analysis gave Bi 77.79, Fe 0.03, Te 19.87, Se 0.76, S 0.76, sum 98.45 wt%, corresponding to $(Bi_{9.02}Fe_{0.02})_{\Sigma9.04}(Te_{3.78}Se_{0.22})_{\Sigma4.00}$. In reflected light, strongly anisotropic in yellowish to bluish colors, bireflectant in creamy or bluish tints. The mineral forms 3-μm grains at the margins of joseite.

Ag_4PbTe_2S and $Ag_8Bi_3Te_7$

Electron-microprobe analyses gave Ag 44.88, Bi 4.85, Pb 20.61, Te 26.37, Se 0.41, S 3.47, sum 100.59 wt%, corresponding to $(Ag_{3.90}Pb_{0.93}Bi_{0.22})_{\Sigma5.05}(Te_{1.94}Se_{0.05})_{\Sigma1.99}S_{1.01}$, and Ag 35.48, Bi 24.01, Te 36.17, sum 95.66 wt%, corresponding to $(Ag_{8.14}Bi_{2.84})_{\Sigma10.98}Te_{7.00}$. The first of the minerals occurs as grains of approximately 1 μm in joseite. Isotropic in reflected light, bluish gray, no bireflectance. The other mineral occurs as 3-μm intergrowths in chalcopyrite. Isotropic in reflected light, gray, no bireflectance, relief close to that of chalcopyrite.

Discussion. The data are insufficient to determine whether these are new minerals: see, for example, the discussion (*Am. Mineral.,* 75, 935, 1990) for previously reported Bi_3S_5. **J.P.**

$Sn_2O_3-Sn_3O_4$

F.J.M. Rietmeijer (1989) Tin in a chondritic interplanetary dust particle. Meteoritics, 24, 43–47.

A portion of a fluffy aggregate, about 60 μm in diameter, which was collected during a cosmic dust program and was from the stratosphere at an altitude between 18 and 20 km, consists mainly of graphitized C (~45%), olivine, layer silicates, submicrometer grains of Ti metal, Ti_2O_3, Bi_2O_3, and three sub-equant, platy, Sn-rich grains. The platy grains are 0.125 × 0.14 μm, 0.15 × 0.20 μm, and 0.15 × 0.17 μm, and only nm thick. Energy-dispersion analysis of the plates gave only Sn and O, and selected-area electron-diffraction patterns gave results interpreted to be consistent with patterns of Sn_2O_3 and Sn_3O_4.

Discussion. The electron-diffraction spacings (15 listed) for the platy mineral are in only moderate agreement with data for Sn_2O_3 (PDF 25–1259) and Sn_3O_4 (PDF 16–737); the author concludes that the grains are "Sn_2O_3 and/or Sn_3O_4." Although reports of native Ti have appeared previously in the geological literature, this phase has not been

approved as a mineral. Bi_2O_3 may be bismite. Ti_2O_3 forms monoclinic and tetragonal synthetic phases but is not known as a mineral. **J.L.J.**

$Be(OH)_2$

T.N. Nadezhina, D.Yu. Pushcharovskii, R.K. Rastsvetaeva, A.V. Voloshin, I.F. Burshtein (1989) Crystal structure of a new natural $Be(OH)_2$ modification. Doklady Akad. Nauk SSSR, 305(1), 95–98 (in Russian).

X-ray powder study of the $Be(OH)_2$ showed the mineral to be monoclinic, space group $P2_1$, a = 11.020(8), b = 4.746(6), c = 8.646(9) Å, β = 98.94(8)°, Z = 12, D_{calc} = 1.92 g/cm³. The X-ray and infrared data indicate that the mineral differs from previously known modifications of $Be(OH)_2$. Occurs as radial aggregates on bavenite crystals in zones of hydrothermally altered, desilicified pegmatites in the Ural Mountains, USSR. **J.P.**

Unnamed $K(Nb,Ti)_3Si(O,OH)_{10}\cdot1.5H_2O$

A.M. Podolskii, I.F. Grigoriev, E.G. Riabeva, K.V. Yurkina (1988) Alteration of aeschynite from greisens in central Kazakhstan. Izvestiya Vyssh. Uchebn. Zaved., Geologia i Razvedka, 1988(9), 38–43 (in Russian).

Microprobe analysis (average of 3; water determined microchemically) gave K_2O 9.5, Fe_2O_3 1.0, Ce_2O_3 0.3, SiO_2 14.1, TiO_2 19.9, ThO_2 3.0, Nb_2O_5 43.5, Ta_2O_5 1.7, H_2O 8.0, sum 100.8, corresponding to $(K_{1.93}Ce_{0.017})_{\Sigma1.95}$-$(Nb_{3.13}Ti_{2.38}Ta_{0.07}Th_{0.11}Fe^{3+}_{0.106})_{\Sigma5.82}Si_{2.25}(O_{17.2}OH_{0.82})\cdot3H_2O$, ideally $K(Nb,Ti)_3Si(O,OH)_{10}\cdot1.5H_2O$. The infrared spectrum indicates the presence of molecular H_2O and OH groups, and the Mössbauer spectrum shows Fe^{3+} to be predominant. DTA-TG-DTG study in air and in argon yielded an endothermal effect at 90 °C (weight loss due to dehydration), an exothermal effect from 230 to 550 °C (loss of H_2O, probably coinciding with oxidation), and small exothermic effects at 673 and 750 °C. Weight losses were 13.7% from 20–550 °C, and 16.5% from 20–1200 °C. The mineral is light yellow to brownish yellow, translucent, brittle, greasy luster, yellowish white streak, D_{meas} 2.91–2.97 g/cm³, H = 188 kg/mm² (100-g load). Isotropic in reflected light, dark gray, intense yellow-white internal reflections. Reflectance measurements (nm, R %): 440,9.8; 460,9.6; 480,9.3; 500,9.0; 520,8.8; 540,8.7; 560,8.6; 580–620,8.5; 640–700,8.4. Refractive index (calc) = 1.82 (yellow light). X-ray study showed the structure of the mineral to be tetragonal and analogous to that of anatase, a = 3.81(1), c = 9.60(3) Å. The strongest X-ray lines are: 3.51(100,102), 1.892(80,200), 1.719(40,210), 1.685(60,203), and 1.482(60,106). The mineral replaced aeschynite in greisens in the Temirschi ring complex in central Kazakhstan, USSR. **J.P.**

New Data

Analcime

F. Pechar (1988) The crystal structure of natural monoclinic analcime ($NaAlSi_2O_6 \cdot H_2O$). Zeits. Kristallogr., 184, 63–69.

Crystal-structural study of a natural analcime from Husa u Marcinova, Bohemia, showed the mineral to be monoclinic, space group $I2/a$, $a = 13.689(2)$, $b = 13.676(2)$, $c = 13.665(2)$ Å, $\beta = 90.38(1)°$. Confirmation of monoclinic symmetry adds to the cubic, tetragonal, and orthorhombic symmetries already known for this mineral (*Am. Mineral.*, 63, 448–460, 1978). **J.L.J.**

Calciovolborthite, Tangeite

R. Basso, A. Palenzona, L. Zefiro (1989) Crystal structure refinement of a Sr-bearing term related to copper vanadates and arsenates of adelite and descloizite groups. Neues Jahrb. Mineral. Mon., 300–308.

Electron-microprobe analysis of a mineral from the Molinello mine, Eastern Liguria, Italy, gave results corresponding to $(Ca,Sr,Pb)(Cu,Mn)(V,As)O_4(OH)$, ideally $CaCu(VO_4)(OH)$. X-ray crystal-structural study confirmed that the mineral is orthorhombic, space group $P2_12_12_1$, isostructural with conichalcite (adelite group). In the past the $CaCu(VO_4)(OH)$ member of the adelite group has been called both tangeite and calciovolborthite, though the former has been relegated to discredited (synonymous) status; because $CaCu(VO_4)(OH)$ does not have a volborthite-type structure, the authors prefer the name tangeite rather than calciovolborthite.

Discussion. No formal proposal to revive tangeite has been made; calciovolborthite is the accepted name for this mineral. **J.L.J.**

Euchlorine

F. Scordari, F. Stasi, A. De Marco (1989) Euchlorin: New crystallographic and chemical data. Neues Jahrb. Mineral. Mon., 541–550.

Euchlorine was found by A. Scacchi in 1869 and was described by him in 1884 as a fumarole product of the 1868 Vesuvius eruption. The mineral was known to be a Cu-Na-K sulfate, but of uncertain formula. The average of seven electron-microprobe analyses of a specimen from Vesuvius (labeled "euchorin 1880," from the collection of the former curator of the Mineralogical Museum of Naples) gave CuO 44.50, K_2O 8.41, Na_2O 6.47, CaO 0.07, MgO 0.17, Al_2O_3 0.06, SO_3 42.18, sum 101.86 wt%; after recalculation to 100 wt%, the results correspond to $Na_{1.180}K_{1.012}Ca_{0.007}Mg_{0.024}Cu_{3.146}O_{1.273}(SO_4)_3$, ideally $NaKCu_3O(SO_4)_3$. $D_{meas} = 3.10–3.27$, $D_{calc} = 3.28$ g/cm³ with $Z = 8$. X-ray single-crystal study showed monoclinic symmetry, space group Cc or $C2/c$, $a = 18.49(1)$, $b = 9.42(1)$,

$c = 14.21(2)$ Å, $\beta = 114.0(1)°$ as refined from the powder pattern (diffractometer, Cu radiation). The strongest powder-pattern lines are 8.44(100,200), 6.61(23,202), 3.475(30, cannot be indexed), 3.237(25,004), 2.852(37,511), 2.843(40,224), 2.816(47,600), 2.673(23,024), and 2.544(45,422,515,712). TGA and DTA curves show weight losses (cumulative, 11%) and corresponding endothermic peaks at 80, 190, and 320 °C. Infrared spectra show the presence of H_2O and SO_4 groups; the water is lost at 320 °C. The interpretation is that poorly crystallized additional phases occur with the euchlorine.

Discussion. The symmetry and composition are new, thus representing a substantial redefinition of euchlorine. The authors report that a crystal-structure study that supports the new formula has been submitted for publication. **J.L.J.**

Lanthanite group

D. Atencio, R.E. Bevins, M. Fleischer, C.T. Williams, P.A. Williams (1989) Revision of the lanthanite group and new data for specimens from Bastnäs, Sweden, and Bethlehem, U.S.A. Mineral. Mag., 53, 639–642.

Although lanthanite was first described in 1825 and was thought to have the formula $(La,Ce)_2(CO_3)_3 \cdot 8H_2O$, the composition was determined at a time when several rare-earth elements could not be differentiated chemically. Reexamination of lanthanite from the type locality of Bastnäs, Sweden, indicates that the mineral is Ce- rather than La-dominant. Nevertheless, analyses of La-, Ce-, and Nd-dominant lanthanite have been reported in the literature, and the lanthanite mineral group thus consists of three species: lanthanite-(La), lanthanite-(Nd), and lanthanite-(Ce). **J.L.J.**

Manandonite

N. Ranorosoa, F. Fontan, A.-M. Fransolet (1989) Rediscovery of manandonite in the Sahatany Valley, Madagascar. Eur. J. Mineral., 1, 633–638.

Wet-chemical analysis of a specimen newly collected from the Antandrokomby pegmatite, Madagascar (type locality) gave SiO_2 23.02, B_2O_3 7.71, Al_2O_3 47.85, Fe_2O_3 0.36, MnO 0.02, MgO 0.03, CaO 0.07, Na_2O 0.13, Li_2O 5.38, H_2O 15.40, sum 99.97 wt%; recalculated to 100% after deduction of 0.40% FeO(OH) impurities, the cations correspond to $(Li_{1.871}Na_{0.021}Ca_{0.005}Mg_{0.03})_{\Sigma1.903}Al_{4.031}$-$(Si_{1.994}B_{1.152}Al_{0.854})_{\Sigma4.000}$, and the ideal formula is $Li_2Al_4[(Si_2AlB)O_{10}](OH)_8$. X-ray single-crystal study indicated orthorhombic symmetry, space group $C222_1$, $a = 5.057(4)$, $b = 8.765(7)$, $c = 13.769(9)$ Å as refined from the powder pattern (114.6-mm Debye-Scherrer camera, Fe radiation); strongest lines are 6.92(100,002), 4.362(25,110), 3.447(80,004), 2.489(15,131,021), 2.376(35,132,202), and 1.863(15,135,205). The thermogravimetric curve shows only a single step, from 200–660 °C, that corresponds to a loss of 15.40 wt% H_2O

(theoretical formula requirement is 13.91 wt%); a sole, equivalent endothermic peak appears on the DTA curve at 650 °C. Manandonite is a 1:1 layer silicate in the serpentine-kaolinite group. **J.L.J.**

Nisaite = phurcalite

R.S.W. Braithwaite, W.H. Paar, J.E. Chisholm (1989) Phurcalite from Dartmoor, Southwest England, and its identity with 'nisaite' from Portugal. Mineral Mag., 53, 583–589.

Nisaite was described in 1970 as a new calcium uranyl phosphate from Nisa, Alto Alentejo, Portugal; although it apparently possessed distinctive optical properties and a unique X-ray powder pattern, the absence of quantitative chemical analyses and single-crystal X-ray data prevented its acceptance as a new mineral. Re-examination of nisaite from Nisa has shown that its optical properties, X-ray powder pattern, and infrared spectrum are in good agreement with results for phurcalite, $Ca_2(UO_2)_3(PO_4)_2(OH)_4 \cdot 4H_2O$. **J.L.J.**

Tokkoite

I.V. Rozhdestvenskaya, L.V. Nikishova, Yu.D. Lazebnik, K.A. Lazebnik (1989) The crystal structure of tokkoite and its relation to the structure of tinaksite. Zeits. Kristallogr., 189, 195–204.

Crystal-structural determination of tokkoite showed the formula to be $K_2Ca_4[Si_7O_{18}(OH)](F,OH)$, isostructural with tinaksite. Tokkoite is triclinic, space group $P\bar{1}$, $a = 10.438(3)$, $b = 12.511(3)$, $c = 7.112(2)$ Å, $\alpha = 89.91(2)$, $\beta = 99.75(2)$, $\gamma = 92.82(2)°$. The cell dimensions are new. **J.L.J.**

Wolframoixiolite

Wang Su, Ma Zhesheng, Peng Zhizhong (1988) The crystal structure of wolframoixiolite. Kexue Tongbao (Foreign Language Edition), 33(16), 1363–1366 (in English).

Chemical analysis gave MnO 6.01, Nb_2O_5 34.78, Ta_2O_5 10.34, FeO 13.58, WO_3 33.42, TiO_2 0.94, SnO_2 0.32, sum 99.39 wt%. Color black, semimetallic luster, H = 520–580 kg/mm², grain size 0.3 × 0.3 × 0.5 mm, short prismatic and elongate along c; yellow in reflected light, with weak anisotropy and bireflection. $D_{meas} = 6.30$, $D_{calc} = 6.42$ g/cm³ with $Z = 2$. X-ray crystal-structural study ($R = 9.33\%$) indicated monoclinic symmetry, space group Pc, $a = 4.674(2)$, $b = 5.673(1)$, $c = 5.050(1)$ Å, $\beta = 90°$. The structure is like that of wolframite. Two sites alternate in ordered arrangement along the **a** axis, but the metals within the sites are disordered; the cation distribution corresponds to $(Fe_{1.011}Mn_{0.4536}Nb_{4959}\square_{0.0395})_{\Sigma 2.000}$ $(Nb_{0.9037}W_{0.7710}Ta_{0.2509}Ti_{0.0632}Sn_{0.0112})_{\Sigma 2.000}O_8$, ideally $(Fe,Mn,Nb)_2(Nb,W,Ta)_2O_8$. Previously reported wolfra-

moixiolite (*Am. Mineral.*, 55, 318–319, 1970) has W > Nb in the B site, and therefore is Nb-rich wolframite. The mineral from China occurs at Qitianling, Hunan Province, in a pegmatite containing potassium feldspar, zinnwaldite, quartz, muscovite, cassiterite, wolframite, and qitianlingite.

Discussion. Synthesis of monoclinic $FeNbO_4$ was reported in *Am. Mineral.*, 49, 242–246, 1964. This new report seems to present a valid redefinition of a previously dubious mineral. **J.L.J.**

Zirconolite*

P. Bayliss, F. Mazzi, R. Munno, T.J. White (1989) Mineral nomenclature: Zirconolite. Mineral. Mag., 53, 565–569.

The compound $CaZrTi_2O_7$ forms superstructures in which the symmetry is monoclinic, orthorhombic, or trigonal. In minerals, some of the constituent elements in these structures differ by more than 0.25 atoms per formula unit; thus, the structures are referred to as polytypoids rather than polytypes. Type specimens of polymignite, zirkelite, and zirconolite are metamict, and the names have been used variously and interchangeably. The following nomenclature has been approved: (1) the noncrystalline (metamict) mineral or mineral with undetermined polytypoid of $CaZrTi_2O_7$ shall be called zirconolite; (2) the orthorhombic mineral of $CaZrTi_2O_7$ shall be called zirconolite-*3O*; (3) the trigonal mineral of $CaZrTi_2O_7$ shall be called zirconolite-*3T*; (4) the monoclinic mineral of $CaZrTi_2O_7$ shall be called zirconolite-*2M*; (5) polymignite (metamict) is zirconolite; (6) the cubic mineral of $(Ti,Ca,Zr)O_{2-x}$ shall be called zirkelite. **J.L.J.**

Discredited Minerals

Fernandinite

P. Bayliss, K.J. Freeman (1989) Mineral nomenclature: Fernandinite. Mineral. Mag., 53, 511.

Fernandinite was described by W.T. Schaller in 1915 as a new vanadyl vanadate from Minasragra, Peru. The chemical analysis, excluding 12.18 wt% insoluble material, was calculated to give a formula $CaO \cdot V_2O_4 \cdot 5V_2O_5 \cdot 14H_2O$. Examination of the type specimen has shown that it consists of 80% bariandite, 10% roscoelite, and 10% gypsum. The discreditation was approved by the CNMNN. **J.L.J.**

Piypite*-caratiite

S.K. Filatov, L.P. Vergasova (1989) Discrediting of caratiite and priority for piypite. Zapiski Vses. Mineral. Obshch., 118(3), 88–90 (in Russian).

Comparison of chemical analyses, X-ray data, and crystal structures of caratiite and piypite indicate that they

are the same mineral. The structure of caratiite was reported by Effenberger and Zeman (*Mineral. Mag.*, 48, 541–546, 1984); differences from the original cell reported for piypite are attributed to twinning. The mineral is tetragonal space group $I4$, $a = 13.60$, $c = 4.98$ Å; $Z = 2\{K_4[Cu_4O_2(SO_4)_4]MeCl\}$, where Me may be partly Cu and partly Na. The CNMNN approved the retention of the name piypite and the discrediting of caratiite. **J.L.J.**

ERRATA

Wawayandaite, a new calcium manganese beryllium boron silicate from Franklin, New Jersey by Pete J. Dunn, Donald R. Peacor, Joel D. Grice, Frederick J. Wicks, and Peter H. Chi (v. 75, p. 405–408). Page 405: The second-to-last line of the abstract should read as follows:

Cleavage is perfect on {100}.

Crystal structures of natural ternary apatites: Solid solution in the $Ca_5(PO_4)_3X$ (X = F,OH,Cl) system by John M. Hughes, Maryellen Cameron, and Kevin D. Crowley (v. 75, p. 295–304). Page 298: In Table 6, line 31, the positional parameters read $x = 0.7399(4)$, $y = 0.2926(2)$, $z = 0.7010(6)$. . . . The z positional parameter is incorrect, and should read as follows:

0.0710(6).

Crystal chemistry of the natural vanadium bronzes by Howard T. Evans, Jr. and John M. Hughes (v. 75, p. 508–521). The formula for fervanite is incorrectly stated as $Fe_4V_4O_{12} \cdot 5H_2O$ in two places: in Table 1 on page 512, and on page 519. The authors did not intend to revise the formulation $Fe_4V_4O_{16} \cdot 5H_2O$, as established by chemical analysis in the original description by Hess and Henderson (1931).

The formula for schubnelite in Table 1 and on page 518 is in error, and should be $Fe_2V_2O_4(OH)_8$, which is equivalent to the formula reported by Cesbron (1970).

Also, the formula for bariandite given in Table 1, shown as $Al_{0.6}V_8O_{20} \cdot 18H_2O$, should be written with $9H_2O$; and the formula for melanovanadite, shown as $CaV_4O_{20} \cdot 10H_2O$, should be written with $5H_2O$ (see Table 4).