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NEW MINERAL NAMES*

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Akhtenskite*

F.V. Chukhrov, A.I. Gorshkov, A.V. Sivtsov, V.V. Berezovskaya, Yu.P. Dikov, G.A. Dubinina, N.N. Varinov (1989) Akhtenskite—The natural analog of ϵ-MnO_2. Izvestiya Akad. Nauk SSSR, ser. geol., No. 9, 75–80 (in Russian, English translation in Internat. Geol. Rev., 31, 1068–1072, 1989).

F.V. Chukhrov, A.I. Gorshkov, V.S. Drits (1987) Advances in the crystal chemistry of manganese oxides. Zapiski Vses. Mineralog. Obshch. 16, 210–221 (in Russian, English translation in Internat. Geol. Rev., 29, 434–444, 1987).

The mineral, whose synthetic counterpart is ϵ-MnO_2, occurs as light gray to black mixtures with cryptomelane and nsutite in a specimen of psilomelane from the Akhtenskoye limonite deposit, South Urals. X-ray photoelectron spectroscopy and energy-dispersive analysis showed only Mn^{4+} and O to be present; no OH or molecular water was detected. The mineral occurs as platy {001} aggregates; hexagonal, with $a = 2.85$, $c = 4.48$ Å, space group $P6_3/mmc$ as indicated by electron-diffraction patterns. Cleavage {001}. Approved by the CNMMN in 1983; subsequently identified as flaky polycrystalline aggregates in ferromanganese encrustations on oceanic basalt from a Permo-Carboniferous guyot at Mt. Zarod in Sikhote Alin, associated with vernadite and buserite; electron-diffraction patterns show rings at 2.45, 2.15, 1.65, and 1.42 Å, corresponding to *hkl* 100, 101, 102, and 110, respectively, from which $a = 2.83$, $c = 4.47$. Energy-dispersive peaks indicate that end-member and Fe-bearing varieties are present, the latter with Fe/Mn = 0.1–0.3. The new name is derived from the initial locality (Akhtenskoye limonite deposit). The original specimen was from the Leningrad Mining Institute, presumably the repository of type material. The mineral is the structural analogue of feroxyhite, δ-$Fe^{3+}O(OH)$, and the general formula is $(Mn_{1-x}Fe_x)O_{2-x}(OH)_x$. **J.L.J.**

Auroantimonate

G.N. Gamyanin, I.Ya. Nekrasov, Yu.Ya. Zhdanov, N.V. Leskova (1988) Auroantimonate—A new natural gold compound. Doklady Akad. Nauk SSSR 301(4), 947–950 (in Russian).

Electron-microprobe analyses (using a JXA-50A probe for Au and Sb, and a JXA-5 probe for O) of one aggregate gave Au 49.7, 50.1, 49.3, Sb 39.2, 39.1, 39.2, O 10.7, 11.2, 11.2, sum 99.6, 100.4, 99.7 wt%; a second aggregate gave Au 52.4, 52.6, Sb 36.7, 36.3, O 11.6, 11.4, sum 100.7, 100.3 wt%; the averages correspond to $AuSb_{1.26}O_{2.76}$ and $Au_{1.02}Sb_{1.15}O_{2.83}$, respectively, close to a theoretical composition $AuSbO_3$. H = 223.8 and 186.8 kg/mm^2. No crystallographic parameters could be deduced from the X-ray powder pattern, in which the following lines were present: 4.18(100), 3.92(20), 3.72(30), 3.12(10), 2.08(10), 2.03(30), 1.719(10), 1.676(10), 2.72(10), 2.59(10), 2.35(90), 2.23(10), 1.588(10), 1.553(10), 1.434(50), and 1.223(30). The 2.35-Å line corresponds to that of native gold. Aggregates observed in immersion oil showed thin, elongate, wormlike grains in which no anisotropy or internal reflection could be detected. Reflectance percentages obtained with a WTiC standard ($R_{g'}$ and $R_{p'}$, respectively) are 420 14.5, 15.8; 440 14.5, 15.4; 460 14.0, 15.0; 480 13.7, 14.7; 500 13.4, 14.5; 520 14.5, 15.5; 540 16.2, 16.8; 560 17.9, 17.8; 580 19.6, 18.9; 600 20.4, 19.6; 620 21.2, 20.2; 640 21.7, 20.4; 660 22.2, 20.5; 680 22.5, 20.5; 700 22.6, 20.5.

Auroantimonate occurs as fillings of microscopic cells with Au walls in a porous and friable variety of Au-Ag ore known as mustard gold, from Eastern Yakutiya, USSR. Other minerals in these fillings include stibnite, valentinite, and aurostibite. The studied material was obtained from unoxidized Au-Sb ore taken from 150 m below the surface. One aggregate (first analysis above) is associated with stibnite and is 0.008 × 0.03 mm in cross section. The aggregate is olive gray and brown-gray in reflected light. The second aggregate consists of similar material in an olive-colored margin, 0.003–0.02 mm thick, around a gold grain that lies between stibnite and quartz. Auroantimonate is interpreted to be a hypogene mineral formed by reaction of Au in contact with Sb_2S_3, or by breakdown of aurostibite to gold and $AuSbO_3$ under oxidizing conditions (0.2–0.4 eV) at 150–200 °C and through the action of hydrothermal solutions.

Discussion. This is the first report of a natural oxide with Au. The available information does not preclude the possibility that the apparently homogeneous auroantimonate is not an ultrafine (submicroscopic) mixture of gold and antimony oxide rather than a Au-Sb oxide. The new mineral and name were not submitted to the CNMMN. **E.S.G.**

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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.

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Cervandonite-(Ce)*

T. Armbruster, C. Bühler, S. Graeser, H.A. Stalder, G. Amthauer (1988) Cervandonite-(Ce), (Ce,Nd,La)(Fe^{3+},Fe^{2+},Ti^{4+},Al)$_3$SiAs(Si,As)O_{13}, a new Alpine fissure mineral. Schweiz. Mineral. Petrogr. Mitt., 68, 125–132.

Twelve electron-microprobe analyses of three specimens gave Ce_2O_3 9.94–12.65, Nd_2O_3 4.40–6.61, La_2O_3 3.88–6.09, Y_2O_3 0.00–1.05, ThO_2 1.92–2.86, UO_2 0.00–1.77, CaO 0.11–0.40, PbO 0.00–0.25, Fe_2O_3 13.99–16.82, FeO 4.20–5.05, TiO_2 10.83–12.52, Al_2O_3 2.14–4.07, SnO_2 0.00–1.24, SiO_2 11.97–17.76, As_2O_5 20.41–26.07, sum 96.41–101.93 wt%. The Fe^{3+}/Fe^{2+} ratio was established as 3/1 by Mössbauer spectroscopy, and As was assumed to be present as As^{5+}. On the basis of 13 O atoms, the average composition is $(Ce_{0.44}Nd_{0.22}La_{0.21}Th_{0.06}Y_{0.03}U_{0.02}Ca_{0.02}Pb_{0.00})_{\Sigma 1.00}(Fe^{3+}_{1.28}Fe^{2+}_{0.43}Ti_{0.96}Al_{0.39}Sn_{0.01})_{\Sigma 3.07}(Si_{1.59}As_{1.37})_{\Sigma 2.96}O_{13}$. The mineral occurs as black, brittle, porous, rosettelike aggregates; adamantine luster, poor {001} cleavage, conchoidal fracture, brownish black streak, VHN_{50} = 450, translucent in thin splinters, D_{calc} = 4.9 g/cm³ with Z = 6. Refractive indices are ~1.99 parallel to a direction in which the grain is yellowish, reddish brown, and ~2.0 where black. In reflected light the reflectance varies from 8 to 12% between 440 and 660 nm. Single-crystal X-ray study indicated monoclinic symmetry, space group *C*2, *Cm*, or *C*2/*m*, a = 11.269(2), b = 19.527(3), c = 7.226(1) Å, β = 121.35(1)°; a superstructure is present, with $b = 3b'$. The X-ray powder pattern (Guinier film, Fe$K\alpha_1$ radiation) has strongest lines of 5.390(80,130), 3.2530(90,060,$\bar{3}31$), 3.0847(80,002), 2.8785(100,061,330,$\bar{3}32$), 2.7867(60,$\bar{2}61$), and 2.6964(50,260).

The mineral occurs in aggregates up to 4 mm in diameter in several narrow fissures at three localities at Pizzo Cervandone (Italian name) or Scherbadung (Swiss name), a mountain ridge that straddles the Italian–Swiss border in the Central Alps. Associated minerals are quartz, albite, white mica, rutile, anatase, chlorite, tourmaline, senaite, hematite, magnetite, chernovite, and synchysite. The new name is for the locality.

Discussion. The specimens used for the description are referred to by numbers with the prefixes NMBE and M, presumably the Naturhistorisches Museum, Bern, and the Naturhistorisches Museum, Basel, respectively. **J.L.J.**

Gartrellite*

E.H. Nickel, B.W. Robinson, J. Fitz Gerald, W.D. Birch (1989) Gartrellite, a new secondary arsenate mineral from Ashburton Downs, W.A. and Broken Hill, N.S.W. Australian Mineral., 4, 83–89.

Electron-microprobe and CHN analyses (avg. of thirteen for the mineral from Ashburton Downs; avg. of two for Broken Hill) gave, respectively, PbO 36.0, 38.62, CuO 15.1, 13.41, ZnO –, 0.31, Fe_2O_3 9.3, 7.74, Al_2O_3 –, 2.09, As_2O_5 33.7, 32.50, SO_3 1.3, 0.74, CO_2 3.7, n.d. (not determined), H_2O 0.5, n.d., sum 99.6, 95.41 wt%. The first corresponds to $Pb_{1.04}Cu_{1.22}Fe_{0.74}(AsO_4)_{1.88}(SO_4)_{0.10}(CO_3)_{0.54}(H_2O)_{0.18}$, simplified as $Pb(Cu,Fe)_2(AsO_4,SO_4)_2(CO_3,H_2O)_x$ where x is about 0.7. That all Fe is trivalent was confirmed by Mössbauer spectroscopy. The mineral is bright yellow to greenish yellow, soft, friable, chalky luster and texture, yellow streak, soluble in conc. HCl; cryptocrystalline, consisting of platelets ~1 × 10 μm. Pale yellow in transmitted light, transparent, highly birefringent, n = 1.94 to 2.00. Electron-diffraction patterns indicated triclinic symmetry; strongest lines of the X-ray powder pattern (80-mm Guinier camera, Cu$K\alpha$ radiation, intensities by diffractometer) are 4.612(70,100), 3.339(70,$02\bar{1}$), 3.203(97,110,$\bar{1}1\bar{1}$), 2.962(100, $\bar{1}21$), 2.915(70,$\bar{1}2\bar{1}$), and 2.522 Å (64,$\bar{1}30$). Calculated cell dimensions are a = 5.454, b = 7.664, c = 5.685, α = 98.0, β = 110.0, γ = 111.1°. D_{calc} = 5.38 g/cm³ with Z = 1 and the average composition of the mineral from Ashburton Downs.

The new mineral occurs at the Anticline copper prospect near Ashburton Downs, Western Australia, as fine-grained coatings and cavity fillings in altered material consisting of quartz, clay minerals, iron oxides, and numerous secondary minerals; also occurs at the Kintore open pit, Broken Hill, N.S.W., as yellowish powdery encrustations associated with drusy brown hidalgoite-beudantite. The new name is for Blair Gartrell, who collected the original specimen. Type material, from Ashburton Downs, is in the Museum of Victoria, Melbourne, Australia. **J.L.J.**

Rittmannite*

Y. Marzoni Fecia di Cossato, P. Orlandi, G. Vezzalini (1989) Rittmannite, a new mineral species of the whiteite group from the Mangualde granitic pegmatite, Portugal. Can. Mineral., 27, 447–449.

Electron-microprobe analysis gave MgO 1.5, Al_2O_3 11.3, CaO 3.3, FeO 12.7 (partitioned as FeO 10.4, Fe_2O_3 2.6), MnO 18.9, P_2O_5 35.9, H_2O (calc.) 19.7, sum 103.6 wt%, corresponding to $(Mn_{0.54}Ca_{0.47})_{\Sigma 1.01}Mn_{1.01}(Fe^{2+}_{1.15}Mn_{0.56}Mg_{0.29})_{\Sigma 2.00}(Al_{1.75}Fe_{0.25})_{\Sigma 2.00}(OH)_{2.02}(PO_4)_4 \cdot 8H_2O$, ideally $Mn^{2+}Mn^{2+}Fe^{2+}Al_2(OH)_2(PO_4)_4 \cdot 8H_2O$. The mineral occurs as pale yellow, transparent, pseudohexagonal crystals averaging 0.3 × 0.3 × 0.04 mm, tabular on {001}; white streak, vitreous luster, H = 3.5, indistinct {001} cleavage, D_{meas} = 2.81(1) in heavy liquids, D_{calc} = 2.83 g/cm³ for Z = 2. Optically biaxial positive, α = 1.622, β' = 1.628, γ_{calc} = 1.654, $2V$ = 43(2)°, $X = b$, $Z \wedge c$ = 7°, nonpleochroic. Single-crystal X-ray study indicated monoclinic symmetry (space group *P*2/*a* by analogy with the whiteite group). The X-ray powder pattern (114.6-mm Gandolfi camera, Fe$K\alpha$ radiation) has strongest lines of 9.38(s,001), 5.66(m,$\bar{1}11$), 4.93(m,$\bar{2}11$), 4.85(m,$\bar{2}02$), 4.69(ms,002), 3.530(m,$\bar{4}02$), 3.458(m,400), 3.274(m,$\bar{4}11$), 2.802(s,$\bar{2}22$), 2.558(m,510), 2.344(m,004), 1.947(m), and 1.884(m); refined cell dimensions are a = 15.01(4), b = 6.89(3), c = 10.16(3) Å, β = 112.82(25)°.

The mineral occurs in the core of a pegmatite that cuts granite near Mangualde, Viseu district, northern Portugal.

Associated minerals are the adularia variety of orthoclase, frondelite, hureaulite, and kryzhanovskite. The name is for Professor Alfred Rittmann (1893–1980), noted volcanologist. Type material is in the Museo di Storia Naturale of Pisa, and the Museo Civico di Storia Naturale, Milan, Italy. **J.L.J.**

Velikite

V.S. Gruzdev, V.Yu. Volgin, E.M. Spiridonov, L.N. Kaplunnik, Ye.A. Pobedimskaya, T.N. Chvileva, N.M. Chernitsova (1988) Velikite Cu_2HgSnS_4—The mercury member of the stannite group. Doklady Akad. Nauk SSSR 300(2), 432–435.

Electron-microprobe analyses (average of six) give Cu 23.16(49), Ag 0.19(7), Hg 29.49(68), Cd 0.16(9), Zn 2.49(25), Fe 0.01(1), Mn 0.02(1), Pb 0.10(5), Sn 17.60(47), Ge 1.31(22), As 0.27(19), Sb 0.11(9), Te 0.05(3), S 24.78(69), Se 0.10(4), Bi, Mo, W not detected, sum 99.84 wt%, corresponding to $(Cu_{1.95}Ag_{0.01})_{\Sigma 1.96}$-$(Hg_{0.78}Cd_{0.01}Zn_{0.20}Pb_{0.01})_{\Sigma 1.00}(Sn_{0.79}Ge_{0.10}As_{0.02}Sb_{0.01})_{\Sigma 0.92}(S_{4.11}$-$Se_{0.01})_{\Sigma 4.12}$, that is, close to a Hg end-member Cu_2HgSnS_4 of the stannite group. The mineral forms small grains and crystals with a tetragonal-scalenohedral habit, up to 1 mm across. Color dark gray, luster metallic, streak gray, H = 215–305 (avg. 270) kg/mm², no cleavage, no internal reflection, D_{meas} = 5.59 (hydrostatic suspension), D_{calc} = 5.27 g/cm³, Z = 1. In reflected light, gray or light gray with greenish-brownish and brownish green tints; bireflectance hardly noticeable, weak pleochroism in brownish and greenish tones sometimes observed; clearly anisotropic with color effects in pale blue and greenish blue tones. Reflectances (R_{max}) from 420 to 700 nm at intervals of 20 nm are 420 24.6, 440 25.2, 460 25.7, 480 26.3, 500 26.6, 520 26.6, 540 26.4, 560 26.2, 580 25.8, 600 25.4, 620 25.2, 640 24.9, 660 24.7, 680 24.5, 700 24.4. X-ray study shows the mineral to be tetragonal, space group $I\bar{4}2m$ (by analogy with stannite). X-ray powder data yield a = 5.554(3), c = 10.911(8) Å; strongest lines (34 given) are 3.17(100,112), 1.958(25,220), 1.941(80,204), 1.671 (40,312), 1.646(35,303), 1.264(25,316), and 1.132-(20,424).

The mineral occurs with stibnite, metacinnabar, aktashite, livingstonite, quartz, and fluorite in the Sb-Hg Khaydarkan deposit, Kirghiziya, USSR. It is named in honor of A.S. Velikiy (1913–1970), a noted investigator of ore deposits in Soviet Central Asia.

Discussion. The crystal structure of the mineral was reported by L.N. Kaplunnik, Ye.A. Pobedimskaya, and N.V. Belov in 1977, *Kristallographiya,* 22(1), 175–177 (summarized in *Am. Mineral.* 62, p. 1260, 1977) at which time the relation to stannite was proposed. No analyses or physical properties were reported in the original description and naming of the mineral. In the present paper the formula and space group are new; the measured and calculated (from X-ray data) densities diverge markedly from one another and from D_{calc} = 5.48 g/cm³ reported in the 1977 paper. The mineral and name were published without prior submission to the CNMMN. **E.S.G.**

Whiteite-(CaMnMg)*

J.D. Grice, P.J. Dunn, R.A. Ramik (1989) Whiteite-(CaMnMg), a new mineral species from the Tip Top pegmatite, Custer, South Dakota. Can. Mineral., 27, 699–702.

Electron-microprobe analysis (H_2O by TG-EGA) for three specimens gave Al_2O_3 12.9, 13.4, 13.6, MgO 9.4, 10.1, 11.7, CaO 5.6, 4.6, 6.3, MnO 12.0, 12.6, 8.8, FeO 1.6, 0.9, 0.1, P_2O_5 38.2, 37.5, 37.7, H_2O 20.8, 20.9, 21.8 (last two by difference), sum 100.5, 100.0, 100.0 wt%; the first analysis corresponds to $(Ca_{0.76}Mn_{0.24})_{\Sigma 1.00}Mn_{1.00}(Mg_{1.78}Fe_{0.17}$-$Mn_{0.05})_{\Sigma 2.00}Al_{1.93}(PO_4)_{4.11}(OH)_{1.46}\cdot 8.1H_2O$, ideally $CaMnMg_2Al_2(PO_4)_4(OH)_2\cdot 8H_2O$. Occurs as individual, dull, bipyramidal crystals up to 1.5 × 0.5 × 0.5 mm, and as anhedral, etched, millimetric blebs; yellow, greenish yellow, pink, or pale lavender in color, white streak, transparent, nonfluorescent, H = 3½, brittle, poor {001} cleavage, D_{meas} = 2.63(2) by heavy-liquid suspension, D_{calc} = 2.64 g/cm³ with Z = 2. Optically biaxial positive, α = 1.580(1), β = 1.584(1), γ = 1.591(1) (Na light), $2V_{meas}$ = 81(5)°, $2V_{calc}$ = 74°; $Y = b$, $Z \wedge c$ = 15°; pleochroism X = mauve, Y = light mauve, Z = colorless. Single-crystal X-ray study indicated monoclinic symmetry, space group $P2/a$ or Pa, a = 14.842(9), b = 6.976(1), c = 10.109(4) Å, β = 112.59(5)° as refined from the powder pattern (114.6-mm Debye-Scherrer camera, Cu$K\alpha$ radiation). Strongest lines of the pattern are 9.31(100,001), 4.85(50,$\bar{2}$11, 210,$\bar{2}$02), 3.51(50,$\bar{3}$12,020), 3.256(40,021), 2.953(50,$\bar{4}$03), 2.867- (40,401), 2.790(80,022), 2.547-(40,510,$\bar{4}$21), and 1.845(40). H_2O corresponding to $5H_2O$, $3H_2O$, and $1H_2O$ is lost in three steps to approximately 500 °C.

The mineral occurs on massive beryl in the Tip Top pegmatite in the Black Hills near Custer, South Dakota, associated with several other secondary phosphates. Type specimens are in the National Museum of Natural Sciences, Ottawa, Canada, and in the Smithsonian Institution, Washington, D.C. The general formula for the whiteite group is $XM(1)M(2)M(3)^{3+}_2(PO_4)_4(OH)_2\cdot 8H_2O$, where M(3) is dominantly Al for the whiteite series and Fe^{3+} for the jahnsite series; other members previously described in the nomenclature system used here are whiteite-(CaFeMg), whiteite-(MnFeMg), and jahnsite-(CaMnMg). Rittmannite (which see) was described contemporaneously, and, as is noted by the present authors, "the whiteite group now has a mixture of both trivial and suffixed names in contrast to most other mineral groups . . . , in which suffixes appear only for rare-earth elements." **J.L.J.**

Zemkorite*

K.N. Yegorov, Z.F. Ushchapovskaya, A.A. Kashayev, G.V. Bogdanov, Yu.I. Sizykh (1988) Zemkorite—A new carbonate from the kimberlites of Yakutiya. Doklady Akad. Nauk SSSR, 301(1), 188–193 (in Russian).

Electron-microprobe analyses of two grains, supplemented by a wet-chemical analysis for CO_2, gave Na_2O 25.61, 25.83, Al_2O_3 0.05, 0.05, K_2O 6.60, 6.21, CaO 28.29, 28.50, MgO, SiO_2, TiO_2, MnO, FeO, BaO, and SrO not detected, CO_2 39.20, sum 99.75, 99.79 wt%, the average corresponding to $(Na_{1.80}K_{0.29})Ca_{1.10}(CO_3)_{1.93}$, ideally $(Na,K)_2Ca(CO_3)_2$. Readily soluble in warm water. Grains are tabular, 0.1–0.5 mm across, and show no faces. Colorless, transparent, luster vitreous to pearly, brittle, H = 2.0. Perfect cleavage parallel to the plane in which grains are tabular. No twinning. D_{meas} = 2.46(2) (suspension), D_{calc} = 2.47 g/cm³. Uniaxial negative, ω = 1.535(1), ϵ = 1.513(1). X-ray study showed the mineral to be hexagonal, $P6_3/mmc$, $P6_3mc$ or $P\bar{6}2c$; the unit-cell parameters from single-crystal and powder data are a = 10.06(2), c = 12.72(1) Å, Z = 8. The strongest lines (42 given) are 6.36(90,002), 4.36(100,200), 3.18(60,004,211), 3.04 (100,203), 2.52(100,220), 2.18(70,400), 2.06(100, 402,106), and 1.797 (80,404).

The mineral was found in cores at depths of 400–450 m in the eastern body of the Udachnaya pipe, Daldyn kimberlite field, Yakutiya, USSR; typically fills thin fractures in unaltered kimberlite, along contacts between groundmass and olivine xenoliths and xenocrysts; rarely as fan-shaped aggregates 3–4 mm across in interstices among large olivine xenocrysts. Associated minerals are shortite and, rarely, halite. There is no evidence for serpentinization of the kimberlite. The mineral is postmagmatic and results from reworking of the kimberlite by highly mineralized sodic solutions derived by interaction of the Udachnaya pipe with subsurface brines from Lower Cambrian country rocks. The name is for the institute where the mineral was studied, namely Institute of the Earth's Crust of the USSR Academy of Science, Siberian Branch (in Russian, Institut *zem*noy *kor*y). Samples are in the A.E. Fersman Mineralogical Museum of the USSR Academy of Science, Moscow.

Discussion. Differs from nyerereite, also $(Na,K)_2Ca(CO_3)_2$, but which is orthorhombic (pseudohexagonal). A full crystal-structure refinement would be desirable to confirm the distinctness of this mineral from nyerereite and related Na-K-Ca carbonates, as the powder patterns of zemkorite and nyerereite have many features in common. **E.S.G.**

Unnamed Au-Pb intermetallic

I.Ya. Nekrasov, Ya.V. Yakovlev, L.A. Pavlova, V.V. Gotovtsev (1988) Unusual inclusions in native gold from kimberlites of the Mir pipe. Doklady Akad. Nauk SSSR 303(5), 1209–1213 (in Russian).

Ranges (and averages) of two sets of electron-microprobe analyses of inclusions in native gold are Au 41.2–48.90 (45.05), and 44.2–58.98 (54.31); Ni trace to 0.21 (0.10), and trace to 0.55 (0.26); Pb 51.3–56.93 (54.12), and 38.53–55.42 (44.47); Zn not detected (n.d.), and traces; Ti n.d. - 0.19; Ag n.d.; Cu traces; sums, 99.27 and 99.04 wt%, that is, the inclusions contain roughly equal amounts of Au and Pb. These inclusions appear homogeneous and gray against a white background (gold) and constitute 10% of the gold grain. At magnifications above 500 the inclusions appear heterogeneous, with a reticulated mesh texture too fine to be resolved by the electron beam. A 57.3-mm Gandolfi X-ray powder pattern contains 15 lines, of which 5 can be matched with those for gold (for which intensities range from 10 to 100). The remaining lines are 2.82(15), 2.6(10), 2.24(10), 1.888(5 broad), 1.608(5), 1.482(5), 1.391(10), 1.369(10), 1.255(10), and 1.207(5). These gave a = 7.36, c = 5.59 Å, close to those for the intermetallic compound $AuPb_2$.

The inclusions were found in gold grains with dimensions 0.05–1.8 mm that contain <10% Ag. The gold was separated from serpentinized and carbonatized kimberlite of the Mir pipe in Yakutiya, USSR. The inclusions are interpreted to have been a metastable intermetallic phase that separated from Au droplets in the kimberlite magma and subsequently broke down to a fine mixture of Au and $AuPb_2$ on cooling.

Discussion. The d values and intensities given for synthetic $AuPb_2$, although cited as being from the ASTM, do not correspond well with the data on cards 8–419 and 25–366, or even with a combination of these. There are significant differences in diffraction-line intensities, and several lines of at least moderate intensity are missing from the X-ray pattern of the natural Au-Pb phase; nonetheless, the results for the natural and synthetic phases show a general correspondence. A similar mineral from an alluvial gold deposit in the USSR was abstracted in *Am. Mineral.*, 73, p. 197, 1988. **E.S.G.**

Unnamed nickel compound

I.Ya. Nekrasov, Ya.V. Yakovlev, L.A. Pavlova, V.V. Gotovtsev (1988) Unusual inclusions in native gold from kimberlites of the Mir pipe. Doklady Akad. Nauk SSSR 303(5), 1209–1213 (in Russian).

Ranges (and averages) of electron-microprobe analyses of inclusions rich in Ni are Au 22.9–88.04 (54.10), Ag 0.11–3.68 (1.15), Ni 2.70–45.6 (18.27), Cu 0–0.60 (0.21), Pb to 0.74, Zn to 1.41, Ti 0.17–5.05 (0.76), Cr to 7.60, S to 0.67 wt%. These inclusions are <3 μm across and are difficult to see because their reflectance is similar to that of their gold host. At magnifications up to 5000 on a JXA-50A microanalyzer, it can be shown that Au is absent in these inclusions; as no other constituent with Z > 10 was detected, these inclusions are native nickel or carbide, boride or nitride of Ni. The inclusions, together with those of $AuPb_2$ (which see), are present in gold grains separated from the Mir kimberlite pipe, Yakutiya, USSR. **E.S.G.**

Unnamed Bi_3S_5

Z.N. Pavlova, N.M. Zhukov, V.L. Levin, P.Ye. Kotel'nikov, B.M. Tasov, S.D. Abulgazina (1988) An intergrowth of tsumoite and Bi_3S_5 of the decomposition structure type. Zapiski Vses. Mineralog. Obshch. 117(6), 691–696 (in Russian).

Six electron-microprobe analyses give Bi 79.44, 79.46, 79.84, 80.13, 79.56, 77.57, Fe –, –, –, –, –, 1.24, S 19.96, 20.44, 20.29, 20.39, 20.43, 21.24, sum 99.40, 99.90, 100.13, 100.52, 99.99, 100.05, equivalent to $Bi_{2.99-3.03}$-$S_{4.97-5.01}$ (five analyses) and $(Bi_{2.80}Fe_{0.17})_{\Sigma 2.97}S_{5.00}$, ideally Bi_3S_5. The mineral is characteristically gray, markedly bireflectant with color changing from gray to grayish white with a soft bluish cast, and strong anisotropy with no color effect. Exsolution lamellae in tsumoite have straight extinction. The mineral differs optically from bismuthinite in that it is noticeably lighter in one extinction position. The mineral forms (1) parallel lamellae in tsumoite that are visible only under oil at magnifications of 800 to 2000 times, (2) margins, 3–5 μm thick, which are around grains of the tsumoite–Bi_3S_5 intergrowth and which are in places continuous with the lamellae, and (3) rare lamellae in bismuthinite grains that are associated with the intergrowths. The Fe-bearing variety occurs as irregular grains, 0.05–0.07 mm across, with native gold in quartz that has permeated a crushed magnetite aggregate. In reflected light, the Fe-bearing variety is light gray with a bluish cast and markedly pleochroic from bluish to yellowish. Anisotropy is strong black-white. In oil, bireflectance and anisotropy are weaker. Reflectance values of the Fe-bearing variety, which exceed those of bismuthinite by 2–4% for $R_{g'}$ and 3–6% for $R_{p'}$, are given in 20-nm steps: 440 46.3, 43.7; 460 46.7, 42.7; 480 46.8, 42.4; 500 46.9, 42.0; 520 47.1, 41.3; 540 47.1, 40.8; 560 46.5, 40.5; 580 45.4, 40.4; 600 44.5, 40.1; 620 43.8, 39.9; 640 43.2, 39.3; 660 42.6, 38.8; 680 42.0, 38.4; 700 41.6, 37.7; 720 41.2, 37.2; 740 40.7, 36.4. The hardness is 164 kg/mm^2. An X-ray powder pattern of the tsumoite–Bi_3S_5 intergrowth contains very weak lines corresponding approximately to the most intense lines of bismuthinite: 3.949(10), 3.540(40), 3.12(100), 2.801(10), 2.512(<10), 2.304(<10), 2.121(20), 1.946(<10), and 1.741(<10). These lines are attributed to Bi_3S_5 and, by analogy with bismuthinite, yield cell parameters of a = 11.15(2), b = 11.27(2), c = 3.99(1) Å, which indicates that Bi_3S_5 belongs to the same structure type as bismuthinite.

The tsumoite–Bi_3S_5 intergrowth occurs in a gold-quartz-arsenopyrite veinlet among diorites in a gold deposit in Kazakhstan, USSR. Aggregates, 0.5–0.8 mm across the width of the intergrowth, are found between arsenopyrite and quartz, and individual grains 0.001–0.03 mm are found along fractures in quartz. The intergrowths are interpreted to have formed from the breakdown of a phase calculated to have a composition $Bi_{3.87}Te_2S_{3.13}$. Bi_3S_5 in the intergrowths and individual grains is inferred to be the latest ore mineral formed in the deposit.

Discussion. The average Bi and S values for the Fe-poor Bi_3S_5 are 79.69 ± 0.30 (1 σ) and 20.30 ± 0.20 wt%, respectively, compared to 80.28% Bi and 19.43% S for an Fe-poor bismuthinite analyzed under the same conditions in this study. The difference between the two analyses, especially in the Bi contents, seems to be less than the precision of microprobe analyses in general. The reported optical distinction from bismuthinite could be due to different orientation of twin(?) lamellae of bismuthinite in bismuthinite. **E.S.G.**

Unnamed $MnSb_2S_4$

D.C. Harris (1989) The mineralogy and geochemistry of the Hemlo gold deposit, Ontario. Geol. Surv. Canada, Econ. Geol. Rep. 38.

Berthierite ($FeSb_2S_4$), most commonly associated with aurostibite and antimony, has been identified in cores from eleven drillholes in the Hemlo deposit. Electron-microprobe analyses of the berthierite indicate up to 4.7 wt% substitution of Mn for Fe; analyses of three samples from one hole gave Mn 13.4, 12.5, 12.4, Fe 0.0, 0.0, 0.0, Sb 52.1, 55.0, 53.7, As 2.4, 1.8, 2.2, S 30.1, 29.9, 30.0, sum 98.0, 99.2, 98.3 wt%, corresponding to $Mn_{1.0}$-$(Sb_{1.98}As_{0.1})$ $S_{4.09}$. This is compositionally the Mn analogue of berthierite, but a weak X-ray powder pattern (not given) indicated that the Hemlo mineral is not structurally related to berthierite. **J.L.J.**

Routhierite, Sb analogue

D.C. Harris (1989) The mineralogy and geochemistry of the Hemlo gold deposit, Ontario. Geol. Surv. Canada, Econ. Geol. Rep. 38.

Routhierite was defined originally as having a formula of the type $MHgAsS_3$, in which M is (Tl,Cu,Ag) with Tl dominant. Ten electron-microprobe analyses of core samples from five drillholes gave results consistent with a formula $CuTlHg_2As_2S_6$. The mineral occurs as anhedral grains, up to 300 μm across, associated with pyrite, stibnite, realgar, cinnabar, parapierrotite, molybdenite, sphalerite, and tetrahedrite-tennantite. Single-crystal X-ray study of the routhierite indicated tetragonal symmetry, a = 9.986(5), c = 11.348(8) Å, similar to those reported previously for the mineral. In addition to the ten analyses showing As > Sb, four have Sb > As; the two analyses with the highest Sb contents gave Cu 5.6, 5.8, Zn 0.3, –, Tl 19.6, 19.3, Hg 36.8, 36.9, As 5.4, 2.8, Sb 12.9, 17.8, S 18.9, 18.7, sum 99.5, 101.3 wt%, corresponding to $(Cu_{0.92}Zn_{0.06})_{\Sigma 0.98}$-$Tl_{1.00}Hg_{1.92}$ $(Sb_{1.12}$ $As_{0.76})_{\Sigma 1.88}$ $S_{6.22}$, and $Cu_{0.96}$ $Tl_{1.00}$ $Hg_{1.94}$ $(Sb_{1.54}$-$As_{0.38})_{\Sigma 1.92}S_{6.18}$. Also reported to occur, but without accompanying data, are unnamed $AgSbTe_2$ and Pb_2Tl_5-$(Sb,As)_{24}S_{43}$; the latter is present as a 100-μm grain in contact with pyrite in a routhierite-bearing sample. **J.L.J.**

Unnamed Mg oxalate

U.M. Cowgill (1989) A naturally occurring alpha magnesium oxalate dihydrate from the northern Jordan Valley (Israel). Mineral. Mag., 53, 505–507.

X-ray diffractometer data obtained from plants collected in the Lake Huleh basin, Jordan Rift Valley, are in good agreement with data for synthetic magnesium oxalate dihydrate (L. Walter-Levy et al., *Bull. Soc. Chim.*, 756–761, 1971). There is a minor contribution to X-ray intensities by associated tridymite, cristobalite, whewellite, weddellite, sylvite, and calcite. The plants were oven-dried at 60 °C for 72 hours, ground to 200 mesh, and treated with dimethyl sulfoxide dispersant prior to drying at room temperature on glass slides. **J.L.J.**

Ba analogue of bannisterite

S. Matsubara, A. Kato (1989) A barian bannisterite from Japan. Mineral. Mag., 53, 85–87.

The most Ba-rich analysis of three, obtained by energy-dispersive methods, gave SiO_2 44.36, Al_2O_3 5.05, FeO 8.96, MnO 28.04, MgO 2.40, CaO 0.43, BaO 2.71, K_2O 0.40, sum 92.35 wt%, corresponding to $(Ba_{0.66}Ca_{0.29})_{\Sigma 0.95}K_{0.32}(Mn_{14.86}Fe_{4.69}Mg_{2.23})_{\Sigma 21.78}(Si_{27.76}Al_{3.73})_{\Sigma 31.49}O_{84}$ on an anhydrous basis for O = 84 and all Fe as FeO. Formula Ba is dominant in all three analyses, but K ranges from $K_{0.93}$ to $K_{0.32}$. The mineral occurs as radial aggregates, up to 0.4 mm across, that form dark brown veinlets in massive caryopilite-rhodochrosite Mn ore at the Kamo mine, Toba City, Mie Prefecture, Japan. The lack of H_2O or structural determinations makes it uncertain whether K is partly substituted by H_3O; although Ba > Ca is present in all analyses (thus indicating a new Ba analogue of bannisterite), additional differentiation may be present, based on K > H_3O and H_3O > K. Until this distinction and definition can be made, the mineral is referred to simply as barian bannisterite. **J.L.J.**

Unnamed Na-P layered titanosilicate

R.K. Rastsetayeva (1988) The crystal structure of a disordered modification of betalomonosovite. Zapiski Vses. Mineralog. Obshch. 117(6), 696–705 (in Russian).

A chemical analysis (wt% not given) and an X-ray structural analysis gave the structural formula $\{Na_{1.22}[(Ti_{0.8}Fe^{3+}_{0.2})_2\,O_4]\}\{Na_{1.28}[(Ti_{0.8}Nb_{0.2})(Ti_{0.4}Nb_{0.2}Mn^{2+}_{0.15}Fe^{3+}_{0.25})(Si_2O_7)_2]\}\{[PO_2(OH)_2]_2(Na_{3.05}Ca_{0.5})\}$. X-ray study showed the mineral to be triclinic, space group $P1$, $a = 5.351(3)$, $b = 7.131(3)$, $c = 14.488(2)$ Å, $\alpha = 102.1(1)$, $\beta = 95.24(3)$, $\gamma = 90.2(1)°$, $D_{meas} = 2.9$ g/cm³. The mineral is from the Lovozero massive, Kola Peninsula, USSR. Betalomonosovite differs from lomonosovite, $Na_2Ti_2Si_2O_9 \cdot Na_3PO_4$ in that about half of the Na atoms in the interlayer positions are replaced by protons (H^+) and in that the P positions are not located around a center of symmetry. X-ray reflections that would indicate doubling of the *b* parameter are absent. In the resulting structure, there are 5 positions for P with occupancies ranging from 0.3 to 1.7, in contrast to fully ordered betalomonosovite, in which there are four fully occupied P positions.

Discussion. Other relevant data are not given. Differs from lomonosovite in cell dimensions, space group, and composition. Betalomonosovite is not an approved mineral name. **E.S.G.**

New Data

Hainite

Z. Johan, F. Čeck (1989) New data on hainite, $Na_2Ca_4[(Ti,Zr,Mn,Fe,Nb,Ta)_{1.50}\square_{0.50}](Si_2O_7)_2F_4$ and its crystallochemical relationship with götzenite, $Na_2Ca_5Ti(Si_2O_7)_2F_4$. C.R. Acad. Sci. Paris, 308, series II, 1237–1242 (in French, extended English abstract).

The name hainite was introduced in 1893 but fell into disuse because the incomplete original description also lacked a quantitative chemical analysis. The type specimen from Friedland, northern Bohemia, consists of a few crystals <1 mm long, two of which were reexamined. The crystals are elongate [001] and show {010} and {100} modified by {$\bar{1}$10}. A representative result from fourteen electron-microprobe analyses of a crystal gave Na_2O 7.48, CaO 32.55, MnO 2.21, TiO_2 8.30, ZrO_2 6.76, Ce_2O_3 1.10, Al_2O_3 0.04, Fe_2O_3 1.37, La_2O_3 0.63, Nb_2O_5 0.82, Ta_2O_5 0.30, SiO_2 32.13, F 10.84, O ≡ F 4.56, sum 99.97 wt%, corresponding to $Na(Na_{0.762}Ca_{0.238})_{\Sigma 1.000}(Ca_{3.998}REE_{0.076})_{\Sigma 4.074}[(Ti_{0.758}\,Zr_{0.400}\,Mn_{0.226}\,Fe_{0.124}\,Nb_{0.044}\,Ta_{0.010}\,Al_{0.006})_{\Sigma 1.568}\square_{2.432}]_{\Sigma 2.000}(Si_{1.951}O_{6.918}F_{0.082})_{\Sigma 2.000}F_4$, ideally $Na_2Ca_4[(Ti,Zr,Mn,Fe,Nb,Ta)_{1.50}\square_{0.50}](Si_2O_7)_2F_4$. X-ray single-crystal study indicated triclinic symmetry, space group $P\bar{1}$ by analogy to götzenite and rosenbuschite, $a = 5.676(2)$, $b = 7.259(3)$, $c = 9.586(3)$ Å, $\alpha = 101.08(4)$, $\beta = 101.14(4)$, $\gamma = 90.27(4)°$, $D_{meas} = 3.148$, $D_{calc} = 3.157$ g/cm³ for the analytical formula and Z = 1. Strongest lines of the X-ray powder pattern (camera diameter 240 mm, Cu radiation) are 3.961(50,$\bar{1}$02), 3.073(90,003), 2.961(100,1$\bar{2}$1), 2.628(50,$\bar{2}$10), 2.493 (50,1$\bar{1}$3,103), 1.896(70,2$\bar{1}$3), and 1.822(50,23$\bar{2}$,13$\bar{4}$). The mineral is concluded to be isostructural with götzenite; the formula of hainite is derived from that of götzenite by the substitution $2Ca^{2+} \rightleftharpoons (Ti,Zr)^{4+} + \square$.

Discussion. The changes in the definition are substantial enough to warrant submission to the CNMMN for approval. **J.L.J.**

Holtedahlite

C. Rømming, G. Raade (1989) The crystal structure of natural and synthetic holtedahlite. Mineral. Petrol., 40, 91–100.

The crystal structure of natural holtedahlite was refined to $R = 0.031$ and gave $a = 11.203(3)$, $c = 4.977(1)$ Å, space group $P31m$. The formula is $Mg_{12}(PO_3OH,CO_3)$-

$(PO_4)_5(OH,O)_6$, requiring Z = 1. The formula, space group, and cell contents are new. **J.L.J.**

Holtite

B.F. Hoskins, W.G. Mumme, M.W. Pryce (1989) Holtite, $(Si_{2.25}Sb_{0.75})B[Al_6(Al_{0.43}Ta_{0.27}\square_{0.30})O_{15}(O,OH)_{2.25}]$: Crystal structure and crystal chemistry. Mineral. Mag., 53, 457–463.

Crystal-structure study of holtite gave orthorhombic symmetry, a = 4.6914(5), b = 11.896(2), c = 20.383(4) Å, space group *Pnma.* The structure is closely related to that of dumortierite, but with extensive substitution of Si by Sb in holtite. **J.L.J.**

Sapphirine polytypes

A.G. Christy, A. Putnis (1988) Planar and line defects in the sapphirine polytypes. Phys. Chem. Minerals, 15, 548–558.

Transmission electron microscopy of various natural and synthetic sapphirines has shown that, in addition to the previously described *1A* and *2M* polytypes, *2A, 4M,* and *5A* structures are present. The *5A* polytype has been found in sapphirine from Naxos, Greece, and the *3A* and *4M* polytypes are present in sapphirine from Finero, Italy. **J.L.J.**

Stibivanite-*2O*

S. Merlino, P. Orlandi, N. Perchiazzi, R. Basso, A. Palenzona (1989) Polytypism in stibivanite. Can. Mineral., 27, 625–632.

The *2O* polytype of stibivanite (Sb_2VO_4) occurs as emerald-green acicular and fibrous crystals in a vein of dolomite at the Buca della Vena iron mine, Apuan Alps, Italy. Cell dimensions refined from the X-ray crystal-structure study are a = 17.916(3), b = 4.790(1), c = 5.509(1) Å, space group *Pmcn.* Optically biaxial positive, pseudo-uniaxial, $n > 1.87$, $X = a$, $Y = b$, $Z = c$. The X-ray powder pattern has strongest lines of 9.00(m,200), 4.62(m,110), 3.097(s,311), 2.986(ms,600), 1.871(m,620), and 1.747-(mw,911). Stibivanite as described originally is the monoclinic polytype and is designated as stibivanite-*2M.* **J.L.J.**

Yafsoanite

D. Jarosch, J. Zemann (1989) Yafsoanite: A garnet-type calcium-tellurium (VI)-zinc oxide. Mineral. Petrol., 40, 111–116.

Crystal-structure analysis of yafsoanite gave cubic symmetry, a = 12.632(2) Å, space group *Ia3d,* R = 0.075, R_w = 0.028. The formula is $Ca_3Te_2Zn_3O_{12}$, with Z = 8. The formula, space group, and cell contents are new. **J.L.J.**