NEW MINERAL NAMES*

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Akhtenskite*


The mineral, whose synthetic counterpart is $e$-$\text{MnO}_2$, 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 $\text{Mn}^{4+}$ and $\text{O}$ to be present; no $\text{OH}$ or molecular water was detected. The mineral occurs as platy (001) aggregates; hexagonal, with $a = 2.85$, $c = 4.48$ Å, space group $P6/mmc$ 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. Zaroa in Sakha 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 ferroxyhite, $\delta$-$\text{Fe}_{3+}^4\text{O(OH)}_2$, and the general formula is ($\text{Mn}_{1-x}$-$\text{Fe}_x$)$_2$O$_2$$_{2-x}$($\text{OH}$)$_x$. J.L.J.

Auroantimonate


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 $\text{Au}_{1.12}$Sb$_{2.76}$O$_{7.28}$ and $\text{Au}_{1.12}$Sb$_{2.76}$O$_{7.28}$, respectively, close to a theoretical composition $\text{AuSb}_2$O$_7$. $H = 223.8$ 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), 1.72(10), 2.59(10), 2.35(90), 2.23(10), 1.58(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 $R_p$) 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, 18.5; 560 17.9, 17.8; 580 19.0, 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 Yakutia, 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 layer above) is associated with stibnite and is 0.008 x 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$_2$S$_3$, 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 ultfine (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.

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


Twelve electron-microprobe analyses of three specimens gave Ce<sub>2</sub>O<sub>3</sub> 9.94–12.65, Nd<sub>2</sub>O<sub>3</sub> 4.40–6.61, La<sub>2</sub>O<sub>3</sub> 3.88–6.09, Y<sub>2</sub>O<sub>3</sub> 0.00–1.05, ThO<sub>2</sub> 1.92–2.86, UO<sub>2</sub> 0.00–1.77, CaO 0.11–0.40, PbO 0.00–0.25, FeO 13.99–16.82, FeO 4.20–5.05, TiO<sub>2</sub> 10.83–12.52, Al<sub>2</sub>O<sub>3</sub> 2.14–4.07, SnO<sub>2</sub> 0.00–1.24, SiO<sub>2</sub> 11.97–17.76, As<sub>2</sub>O<sub>3</sub> 20.41–26.07, sum 96.41–101.93 wt%. The Fe<sup>3+</sup>/Fe<sup>2+</sup> ratio was established as 3/1 by Mössbauer spectroscopy, and As was assumed to be present as As<sup>3+</sup>. On the basis of 13 O atoms, the average composition is (Ce<sub>0.44</sub>Nd<sub>0.22</sub>La<sub>0.22</sub>Th<sub>0.00</sub>Y<sub>0.00</sub>)<sub>U<sub>0.00</sub>Ca<sub>0.02</sub>Pb<sub>0.00</sub>[Fe<sub>13</sub>Fe<sub>2</sub>3Ti<sub>2</sub>3Al<sub>0.5</sub>Sn<sub>0.5</sub>]<sub>2</sub>3O<sub>11</sub>)<sub>0.93</sub>[Si<sub>11</sub>9-M<sub>0.5</sub>S<sub>3.7</sub>]<sub>0.93</sub>[PO<sub>4</sub>]<sub>0.93</sub>[OH]<sub>0.5</sub>·8H<sub>2</sub>O. The mineral occurs as black, brittle, porous, rosettelike aggregates; adamantine luster, poor (001) cleavage, conchoformal fracture, brownish black streak, VHN<sub>10</sub> = 450, translucent in thin splinters, D<sub>calc</sub> = 4.9 g/cm<sup>3</sup> 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 reflectivity varies from 8 to 12% between 440 and 660 nm. Single-crystal X-ray study indicated monoclinic symmetry, space group C<sub>2</sub>, P<sub>2</sub>1/a, or C<sub>2</sub>/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, FeKα, radiation) has strongest lines of 5.390(80, 130), 3.2530(90, 060, 331), 3.0847(80, 002), 2.8785(100, 061, 330, 332), 2.7867(60, 261), and 2.6774(80, 130). Calculated cell dimensions are a = 5.454, b = 7.664, c = 5.685, α = 98.0, β = 110.0, γ = 111.1°, D<sub>calc</sub> = 5.38 g/cm<sup>3</sup> 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, New South Wales, 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**


Electron-microprobe analysis gave MgO 1.5, Al<sub>2</sub>O<sub>3</sub> 11.3, CaO 3.3, FeO 12.7 (partitioned as FeO 10.4, Fe<sub>2</sub>O<sub>3</sub> 2.6), MnO 18.9, P<sub>2</sub>O<sub>5</sub> 35.9, H<sub>2</sub>O (calc.) 19.7, sum 103.6 wt%, corresponding to (Mg<sub>0.04</sub>Ca<sub>0.29</sub>)<sub>0.10</sub>Mn<sub>0.05</sub>(Fe<sub>2</sub>O<sub>3</sub>;<sub>3</sub>Fe<sub>2</sub>O<sub>3</sub>;<sub>3</sub>Mn<sub>0.5</sub>)<sub>2</sub>30(Al<sub>1.29</sub>Fe<sub>2.71</sub>)<sub>2</sub>30(OH)<sub>1.52</sub>(PO<sub>4</sub>)<sub>1.82</sub>H<sub>2</sub>O, ideally Mn<sup>2+</sup>·Mn<sup>2+</sup>·Fe<sup>2+</sup>·Al<sup>3+</sup>(OH)<sup>1</sup>(PO<sub>4</sub>)<sub>1</sub>·H<sub>2</sub>O. 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<sub>calc</sub> = 2.83(1) in heavy liquids, D<sub>meas</sub> = 2.83 g/cm<sup>3</sup> for Z = 2. Optically biaxial positive, α = 1.622, β = 1.628, γ = 1.654, 2V = 43(2)°, X = b, Z = c, α = γ = 78°, nonpleochroic. Single-crystal X-ray study indicated monoclinic symmetry (space group P2<sub>1</sub>/a by analogy with the whitite group). The X-ray powder pattern (114.6-mm Gandolfi camera, FeKα radiation) has strongest lines of 9.38(s,001), 5.66(m,11), 4.93(m,211), 4.85(m,202), 4.69(m,002), 3.53(m,042), 3.45(m,400), 3.27(m,411), 2.80(s,222), 2.58(m,510), 2.34(m,004), 1.94(m), and 1.88(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 Manguade, Viseu district, northern Portugal.
Associated minerals are the adularia variety of orthoclase, feldspatite, hureaulite, and kryzanovskite. 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.I.J.

**Velikite**


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), Sn 0.10(5), S 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 $(Cu_{1.65}Ag_{0.03}Hg_{0.06})2Sn_{2.00}Se_{1.32}$ that is close to a Hg end-member Cu$_2$HgSnS$_4$ 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/mm$^2$, no cleavage, no internal reflection. $D_{max}$ = 5.59 (hydrostatic suspension), $D_{ave}$ = 5.27 g/cm$^3$, Z = 1. In reflected light, gray or light gray with greenish-brown 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, 450–25.8, 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 $I4_2/m$ (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, aktaelite, livingstonite, quartz, and fluorite in the Sh-Sg Khaydarkan deposit, Kirghizia, 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, *Kristallografiya*, 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/cm$^3$ reported in the 1977 paper. The mineral and name were published without prior submission to the CNMMN. E.S.G.

**Whiteite-(CaMnMg)*


Electron-microprobe analysis (H$_2$O by TG-EGA) for three specimens gave Al$_2$O$_3$, 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$_2$O$_5$ 38.2, 37.5, 37.7, H$_2$O 20.8, 20.9, 21.8 (last two by difference), sum 100.5, 100.0, 100.0 wt%; the first analysis corresponds to $(Ca_{0.76}Mn_{0.24}Mg_{0.00})2(PO_{4})_{2}(OH)_{1.1}(H_2O)_{3.8}$. Occurs as individual, dull, bipyramidal crystals up to 1.5 x 0.5 x 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, $D_{max} = 2.63(2)$ by heavy-liquid suspension, $D_{calc} = 2.64$ g/cm$^3$ with Z = 2. Optically biaxial positive, $\alpha = 1.580(1)$, $\beta = 1.584(1)$, $\gamma = 1.591(1)$ (Na light), $2V_{meas} = 81°$, $2V_{calc} = 74°$, $Y = b, Z = c = 15°$, pleochroism $X =$ mauve, $Y =$ light mauve, $Z =$ colorless. Single-crystal X-ray study indicated monoclinic symmetry, space group $P2/a$ or $Pb$, $a = 14.842(9), b = 6.976(1), c = 10.109(4)$ Å, $\beta = 112.59°$(5) as refined from the powder pattern (114.6-mm Debye-Scherrer camera, CuKα radiation). Strongest lines of the pattern are 9.31(100,001), 4.85(50,211, 210,202), 3.51(50,312,020), 3.256(40,021), 2.935(50,403), 2.867 (40,401), 2.790(80,022), 2.547(40,510,421), and 1.845(40). H$_2$O corresponding to 5H$_2$O, 3H$_2$O, and 1H$_2$O 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 $X(Mn_{3/2}Mg_{1/2})(PO_4)_{2}(OH)_2.8H_2O$, where Mn(3) is dominantly Al for the whiteite series and Fe$^{3+}$ for the jahnite series; other members previously described in the nomenclature system used here are whiteite-(CaFeMg), whiteite-(MnFeMg), and jahnite-(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.I.J.

**Zemkorite**


Electron-microprobe analyses of two grains, supplemented by a wet-chemical analysis for CO₂, gave Na₂O 25.61, 25.83, Al₂O₃ 0.05, 0.05, K₂O 6.60, 6.21, CaO 28.29, 28.50, MgO 0.20, SiO₂, TiO₂, MnO, FeO, BaO, and SrO not detected, CO₂ 39.20, sum 99.75, 99.79 wt%, the average corresponding to (Na₉₋₁₀ K₉₋₁₀)Ca₁₆₋₁₇(CO₃)₉₃, ideally (Na,K)₉₋₁₀Ca(CO₃)₉₃. Readily soluble in warm water. Grains are tabular, 0.1–0.5 mm across, and show no cores. Colorless, transparent, luster vitreous to pearly, brittle, H = 2.0. Perfect cleavage parallel to the plane in which grains are tabular. No twinning. D₄₉₅₋₅₀ = 2.46(2) (suspension), D₄₉₅₋₅₀ = 2.47 g/cm³. Uniaxial, ω = 1.535(1), ε = 1.513(1). X-ray study showed the mineral to be hexagonal, P₆₃/mmc, P₆₃/mmc (I) = 2.46, c = 12.7(1) Å, Z = 8. The strongest lines (42 given) are 6.36(90.002), 4.36(100.200), 3.18(60.004211), 3.04 (100.203), 2.52(100.220), 2.18(107.400), 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, Daldykan 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 zemnoy kory). Samples are in the A.E. Fersman Mineralogical Museum of the USSR Academy of Science, Moscow.

Discussion. Differs from nyerereite, also (Na,K)₂-Ca(CO₃)₉₃, 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**


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), 2.60(15), 2.24(15), 1.88(5 broad), 1.60(5), 1.482(5), 1.391(15), 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 AuPb₂.

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 on cooling.

Discussion. The d values and intensities given for synthetic AuPb₂, 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**


Ranges (and averages) of electron-microprobe analyses of inclusions rich in Ni are Au 19.9–88.04 (54.10), Ag 0.11–3.68 (1.15), Ni 2.70–45.6 (18.27), Cu 0.60-0.60 (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 3000 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 AuPb₂ (which see), are present in gold grains separated from the Mir kimberlite pipe, Yakutiya, USSR. E.S.G.
Unnamed Bi$_{3}$S$_{4}$


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$_{2.99}$, S$_{4.97}$, five analyses) and (Bi$_{2.80}$Fe$_{0.17}$)$_{2.97}$, S$_{5.00}$ ideally Bi$_{3}$S$_{4}$. 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 tsunoite 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 tsunoite 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 tsunoite–Bi$_{3}$S$_{4}$ 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 $R_p$ 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 tsunoite–Bi$_{3}$S$_{4}$ 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$_{3}$S$_{4}$ 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$_{3}$S$_{4}$ belongs to the same structure type as bismuthinite. In addition to the 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, –, Ti 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$_{0.08}$)$_{20.98}$, Tl$_{0.02}$Hg$_{0.92}$ (Sb$_{1.12}$As$_{0.33}$)$_{21.88}$, S$_{2.22}$, and Cu$_{0.94}$Ti$_{1.05}$Hg$_{0.94}$ (Sb$_{0.90}$As$_{0.33}$)$_{24.62}$S$_{6.18}$. Also reported to occur, but without accompanying data, are unnamed AgSbTe$_2$ and Pb$_{1-}$ (Sb$_{2}$As$_{2}$)$_{2}$S$_{4}$; the latter is present as a 100-μm grain in contact with pyrite in a routhierite-bearing sample. J.L.J.

Discussion. The average Bi and S values for the Fe-poor Bi$_{3}$S$_{4}$ 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$_2$S$_4$


Berthierite (FeSb$_2$S$_4$), 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$_{0.98}$, (Sb$_{1.80}$As$_{0.20}$)$_{5.00}$. 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


Routhierite was defined originally as having a formula of the type MHgAs$_{3}$, 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 CuTlHgAs$_{3}$,S$_{2}$, 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, –, Ti 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$_{0.08}$)$_{20.98}$, Tl$_{0.02}$Hg$_{0.92}$ (Sb$_{1.12}$As$_{0.33}$)$_{21.88}$, S$_{2.22}$, and Cu$_{0.94}$Ti$_{1.05}$Hg$_{0.94}$ (Sb$_{0.90}$As$_{0.33}$)$_{24.62}$S$_{6.18}$. Also reported to occur, but without accompanying data, are unnamed AgSbTe$_2$ and Pb$_{1-}$ (Sb$_{2}$As$_{2}$)$_{2}$S$_{4}$; the latter is present as a 100-μm grain in contact with pyrite in a routhierite-bearing sample. J.L.J.
**Unnamed Mg oxalate**


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, weddelite, 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**


The most Ba-rich analysis of three, obtained by energy-dispersive methods, gave SiO2 44.36, Al2O3 5.05, FeO 8.96, MnO 28.04, MgO 2.40, CaO 0.43, BaO 2.71, K2O 0.40, sum 92.35 wt%, corresponding to (Ba0.66Ca0.29)20.91+ K0.32(Mn4.80Fe5.94Mg5.12)22.83(Si37.27Al17.13)23.46O64+ on an anhydrous basis for O = 84 and all Fe as FeO. Formula Ba is dominant in all three analyses, but K ranges from K0.95 to K0.32. The mineral occurs as radial aggregates, up to 0.4 mm across, that form brown dark veinlets in massive carpyolithe-rodhochrosite Mn ore at the Kamo mine, Toba City, Mie Prefecture, Japan. The lack of H2O or structural determinations makes it uncertain whether K is partly substituted by H2O; although Ba > Ca is present in all analyses (thus indicating a new Ba analogue of bannisterite), additional differentiation may be present, based on K > H2O and H2O > 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**


A chemical analysis (wt% not given) and an X-ray structural analysis gave the structural formula \(\{\text{Na}_{12.22}\{\text{Ti}_{0.70\text{Fe}^{3+}0.30}\}2\times\text{O}3\}\{\text{Na}_{12.22}\{\text{Ti}_{0.40\text{Fe}^{3+}0.60}\}2\times\text{Mn}_{0.32}\{\text{Fe}^{5+}0.20\}\{\text{Si}_{1.96}\text{Al}_{0.04}\}\}2\times(\text{PO}4\text{OH})2\times(\text{Na}0.36\text{Ca}0.64))\). X-ray study showed the mineral to be triclinic, space group \(\text{P1}\), \(a = 5.351(3), b = 7.131(3), c = 14.488(2)\) Å, \(\alpha = 102.1(1), \beta = 95.24(3), \gamma = 90.2(1)\)°, \(D_{\text{meas}} = 2.9\) g/cm³. The mineral is from the Lovozero massive, Kola Peninsula, USSR. Betalomonosovite differs from lomonosovite, \(\text{Na}_2\text{Ti}_7\text{Si}_{25}\text{O}_{80}\), in that about half of the Na ions in the interlayer positions are replaced by protons (H+). 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. Ceck (1989) New data on hainite, \(\text{Na}_2\text{Ca}_{4}\{\text{Ti}_{1.45}\text{Zr}_{0.55}\text{Mn}_{0.07}\text{Fe}_{0.39}\text{Nb}_{0.05}\text{Ta}_{0.01}\}\{\text{Si}_{2.07}\text{O}_{19}\}F_4\) and its crystallochemical relationship with götzenite, \(\text{Na}_2\text{Ca}_{4}\{\text{Ti}_{1.15}\text{Zr}_{0.31}\text{Mn}_{0.45}\text{Fe}_{0.15}\text{Nb}_{0.05}\}\{\text{Si}_{2.07}\text{O}_{19}\}F_4\). 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 [110]. A representative result from fourteen electron-microprobe analyses of a crystal gave \(\text{Na}_2\text{Ca}_{4}\{\text{Ti}_{1.45}\text{Zr}_{0.55}\text{Mn}_{0.07}\text{Fe}_{0.39}\text{Nb}_{0.05}\text{Ta}_{0.01}\}\{\text{Si}_{2.07}\text{O}_{19}\}F_4\) and its crystallochemical relationship with götzenite, \(\text{Na}_2\text{Ca}_{4}\{\text{Ti}_{1.15}\text{Zr}_{0.31}\text{Mn}_{0.45}\text{Fe}_{0.15}\text{Nb}_{0.05}\}\{\text{Si}_{2.07}\text{O}_{19}\}F_4\) to be isomorphic with the mineral götzenite; the formula of hainite is derived from that of götzenite by the substitution \(2\text{Ca}^{2+} = (\text{Ti},\text{Zr})^{4+} + \) + \(\square\). Discussion. The changes in the definition are substantial enough to warrant submission to the CNMMN for approval. J.L.J.

**Holtedahelite**


The crystal structure of natural holtedahelite was refined to \(R = 0.031\) and gave \(a = 11.203(3), c = 4.977(1)\) Å, space group \(\text{P31m}\). The formula is \(\text{Mg}_{12}(\text{PO}4\text{OH},\text{CO}3)\)
(PO₄)(OH, O)₉, requiring Z = 1. The formula, space group, and cell contents are new. J.L.J.

**Holtite**


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**


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

**Stibivanite-2O**


The 2O polytype of stibivanite (Sb₂V₂O₈) 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**


Crystal-structure analysis of yafsoanite gave cubic symmetry, a = 12.632(2) Å, space group Ia3d, R = 0.075, Rw = 0.028. The formula is Ca₃Te₃ZnO₁₂, with Z = 8. The formula, space group, and cell contents are new. J.L.J.