

NEW MINERAL NAMES*

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Astrocyanite-(Ce)*

M. Deliens, P. Piret (1990) Astrocyanite-(Ce), $\text{Cu}_2\text{REE}_2(\text{UO}_2)(\text{CO}_3)_3(\text{OH})_2 \cdot 1.5\text{H}_2\text{O}$, a new mineral from Kamoto, Shaba, Zaire. *Eur. J. Mineral.*, 2, 407–411 (in French, English abstract).

Electron-microprobe and CHN analyses (H_2O by difference) gave CuO 15.55, UO_3 28.16, CaO 0.61, Ce_2O_3 11.83, Nd_2O_3 9.74, La_2O_3 3.38, Pr_2O_3 2.48, Sm_2O_3 2.00, Y_2O_3 0.15, CO_2 21.40, H_2O 4.70, sum 100 wt%, corresponding to $2.02 \text{CuO} \cdot 0.98[(\text{Ca}_{0.05})(\text{Ce}_{0.37}\text{Nd}_{0.30}\text{La}_{0.11}\text{Pr}_{0.08}\text{Sm}_{0.06}\text{Y}_{0.01})]_2\text{O}_3 \cdot 1.02\text{UO}_3 \cdot 5.02\text{CO}_2 \cdot 2.7\text{H}_2\text{O}$, ideally $\text{Cu}_2\text{REE}_2(\text{UO}_2)(\text{CO}_3)_3(\text{OH})_2 \cdot 1.5\text{H}_2\text{O}$. Occurs as pale blue, bright blue, and blue-green delicate millimetric rosettes of tablets, platy {001}, translucent to opaque with an earthy luster; also as isolated, vitreous, tabular blue crystals. Cleavage {001}, $H = 2-3$, $D_{\text{meas}} = 3.80$, $D_{\text{calc}} = 3.95 \text{ g/cm}^3$ with $Z = 12$, soluble with effervescence in dilute HCl. Optically uniaxial negative, $\epsilon = 1.638(2)$, $\omega = 1.688(2)$, ω normal to {001}; strongly pleochroic from bright blue (ω) to pale blue, almost colorless. X-ray single-crystal study indicated hexagonal symmetry, space group $P6/mmm$ or a corresponding subgroup, $a = 14.96(2)$, $c = 26.86(4) \text{ \AA}$; the strongest lines of the powder pattern (114.6-mm Debye-Scherrer camera, copper $K\alpha$ radiation) are 13.3(40,002), 6.73(100,004), 4.30(50,300), 4.16(60,205), 3.72(90,220), 2.488(40,330), 2.154(40,600), and 2.071(40,520).

The mineral was found as an oxidation product of uraninite in the East Kamoto Cu-Co deposit, southern Shaba, Zaire. Associated minerals are uranophane, kamotoite-(Y), francoisite-(Nd), shabaite-(Nd), schuilingite, and masuyite. The new name alludes to the combined star-like morphology and color (Greek for blue), as well as the dominant REE. Type material is in the Institut royal des Sciences naturelles de Belgique, Brussels, Belgium. J.L.J.

Burpalite*

S. Merlino, N. Perchiazzini, A.P. Khomyakhov, D.Y. Pushcharovskii, I.M. Kulikova, V.I. Kuzmin (1990) Burpalite, a new mineral from Burpalinskii massif, North Transbaikal, USSR: Its crystal structure and OD character. *Eur. J. Mineral.*, 2, 177–185.

Burpalite, ideally $\text{Na}_2\text{CaZrSi}_2\text{O}_7\text{F}_2$, a new member of the cuspidine-wöhlerite-låvenite family, is monoclinic, space group $P2_1/a$, $a = 10.1173(8)$, $b = 10.4446(6)$, $c = 7.2555(3) \text{ \AA}$, $\beta = 90.039(7)^\circ$. Strongest lines of a 114.6-mm Gandolfi X-ray pattern ($\text{FeK}\alpha$ radiation) are 3.306(m,130), 3.035(m,131), 2.962(vs,202), 1.886(ms,520), 1.787s2,432,432), 1.678(m,243), and 1.556(ms,360). The structure, which was refined to $R = 0.067$, showed that burpalite-type and låvenite-type structures are two distinct ordered members in a family of order-disorder structures.

Burpalite occurs in a fenitized sandstone at the western contact of the Burpalinskii alkaline massive, 120 km northeast of the northern extremity of Lake Baikal, North Transbaikal, USSR. The new name is for the locality. Type material is in the Fersman Mineralogical Museum, Moscow, and in the Museo di Storia Naturale dell'Università di Pisa, Pisa, Italy.

“Orthorhombic låvenite”, reported previously from the same locality as burpalite, consists of a twinned monoclinic phase with $a = 11.11$, $b = 10.05$, $c = 7.23 \text{ \AA}$, $\beta = 108.99^\circ$. The phase is probably a polytype of burpalite. Baghdadite and burpalite are probably isostructural and related by the coupled substitutions $\text{Na}^+ + \text{F}^- \approx \text{Ca}^{2+} + \text{O}^{2-}$.

Discussion. A description of the physical and optical properties of burpalite was given in the abstract for the then-unnamed mineral in *Am. Mineral.*, 75, 436–437 (1990). The improved X-ray powder data given above are from a crystal free of låvenite-type domains. J.L.J.

Byelorussite-(Ce)*

E.P. Shpanov, G.N. Netschelyustov, S.V. Baturin, L.S. Solntseva (1989) Byelorussite-(Ce)- $\text{NaMnBa}_2\text{Ti}_2\text{-Si}_8\text{O}_{26}(\text{F},\text{OH}) \cdot \text{H}_2\text{O}$ —A new mineral of the joaquinite group. *Zapiski Vses. Mineralog. Obsch.*, 118(5), 100–107 (in Russian).

Electron-microprobe analysis (average of 4) gave Na_2O 2.08, K_2O 0.40, SrO 0.43, BaO 20.58, MnO 2.58, FeO 0.82, MgO 0.15, ZnO 1.58, Ce_2O_3 12.13, La_2O_3 8.33, Pr_2O_3 0.58, Nd_2O_3 2.3, Sm_2O_3 0.1, Gd_2O_3 0.15, $\Sigma\text{REE}_2\text{O}_3$ 23.59, SiO_2 33.98, TiO_2 11.35, F 0.98, $\text{O} \equiv \text{F}_2$ 0.41, sum 98.11, H_2O (calc.) 1.45, sum 99.56 wt%, corresponding to $(\text{Na}_{0.95}\text{-K}_{0.12})_{\Sigma 1.07}(\text{Mn}_{0.52}\text{Zn}_{0.27}\text{Fe}_{0.16}\text{Mg}_{0.05})_{\Sigma 1.00}(\text{Ba}_{1.90}\text{Sr}_{0.06})_{\Sigma 1.96}(\text{Ce}_{1.05}\text{-La}_{0.72}\text{Nd}_{0.19}\text{Pr}_{0.05}\text{Gd}_{0.01}\text{Sm}_{0.01})_{\Sigma 2.03}\text{Ti}_{2.01}\text{Si}_{8.00}\text{O}_{26}[\text{F}_{0.73}\text{-}(\text{OH})_{0.27}]_{\Sigma 1.00} \cdot \text{H}_2\text{O}$. Spectral analysis revealed (wt%) Nb 0.06, Ta 0.03, Be 0.1, Pb 0.03, Cd 0.001, Sn 0.001, Ge

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

0.0006, Y 0.07, Yb 0.0009. The presence of OH and H₂O was confirmed by infrared spectroscopy.

Tabular and thin-tabular crystals of the mineral are up to 25 × 20 × 4 mm and are fractured on margins. Cleavages are filled with quartz or a fine mixture of brookite, bastnäsinite, and montmorillonite. Pale yellow to pale brown color, colorless streak, cleavages {001} perfect, {100} imperfect, and {010} very imperfect. Vitreous luster, very brittle, $H = 5.5\text{--}6.0$, $D_{\text{meas}} = 3.92$, $D_{\text{calc}} = 4.09$ g/cm³. Optically biaxial positive, $\alpha = 1.743$, $\beta = 1.760(3)$, $\gamma = 1.820(5)$ at 589 nm, $2V = 58\text{--}62^\circ$. Optic axis plane (010), negative elongation, $X = a$, $Y = b$, $Z = c$. Pleochroism absent to very weakly yellow with $Z > Y \approx X$. No luminescence in UV. The infrared spectrum has absorption bands at 3510, 3480, 1610, 1450, 1200, 1085, 1040, 1015, 985, 920, 900, 800, 785, 720, 690, 655, 545, 495, 470, 445, and 410 cm⁻¹. X-ray study shows the mineral to be orthorhombic, $a = 10.57(6)$, $b = 9.69(6)$, $c = 22.38(10)$ Å, space group $P2_12_1$. The strongest lines (62 given) of the powder pattern are: 4.42(59B,022,114), 3.00(68,313), 2.95(63,224,026), 2.91(52,117), 2.783(100,008,225), and 2.606(52,035).

Byelorussite-(ce) occurs in a salband of a quartz vein in lower Proterozoic metasomatized granosyenites belonging to the Zhitkovitschskij horst, Homel district, Byelorussia SSR. The mineral is associated with quartz, magnesioriebeckite, aegerine, perthite, albite, leucophanite, and titanite. The name is for the locality. Type material is at the Fersman Mineralogical Museum, Moscow. J.P.

Chiluite*

Xiuzhen Yong, Deren Li, Guanxin Wang, Mengxiang Deng, Nansheng Chen, Shuzhen Wang (1989) A study of chiluite—A new mineral found in Chilu, Fujian, China. *Acta Mineralogica Sinica*, 9(1), 9–14 (in Chinese, English abstract).

Twenty-four electron-microprobe analyses gave an average and (range) of Bi₂O₃ 68.59 (71.90–63.71), TeO₃ 15.83 (18.65–12.07), MoO₃ 15.40 (19.04–13.18), Sb₂O₃ 0.17 (0.29–0.07), WO₃ 0.21 (0.33–0.01), sum 99.55 [100.20] wt%; the presence of O was confirmed, and CHN analyses of the synthetic analogue gave O contents in the appropriate range. Ratios of Bi:Te:Mo:O approximate 6:2:2:21, and the ideal formula is Bi₆Te₂Mo₂O₂₁. Oxidation states are based on the O values obtained by difference from 100 wt%. The mineral occurs as plumose replacements in joseite inclusions in bismuthinite; as veinlets and as irregular to hexagonal isolated grains isolated in bismuthinite; as a rim on koechlinite, the exterior having a hexagonal outline. Color yellow, grain size generally 10–20 μm (maximum 42 μm). Gray in reflected light, weakly anisotropic, no birefractance, gray-brown internal reflection. Reflectance values are given in 10-nm steps; representative values for R'_g and R'_p are: 410 20.75, 19.45; 430 20.45, 19.25; 450 20.00, 18.80; 470 19.50, 18.40; 490 18.90, 18.00; 510 18.60, 17.75; 530 18.40, 17.50; 550 18.25, 17.25; 570

18.05, 17.00; 590 17.80, 16.75; 610 17.60, 16.65; 630 17.40, 16.50; 650 17.30, 16.45; 670 17.20, 16.30; 690 17.00, 16.15. For the largest grain, $H_{10} = 108$ kg/mm² (Mohs 3.2); $D_{\text{meas}} = 3.65$, $D_{\text{calc}} = 3.67$ g/cm³ with $Z = 1$. In transmitted light, parallel extinction, negative elongation, optically uniaxial negative, $\epsilon = 2.3(1)$, $\omega = 2.4(1)$. Strongest lines of the X-ray powder pattern, indexed with a hexagonal cell of $a = 8.970$, $c = 12.207$ Å, are: 3.300(100,004), 3.050(90,104), 2.510(50,105), 2.060(50,312), and 1.655(50,008). Indexing is in harmony with the space groups $P6_322$, $P6_3m$, and $P6_3$. Synthesized at 400, 500, 600, 700, 800, and 900 °C (heating times 3–28 days); highest temperatures give the coarsest grains (to 0.2 mm). Refractive indices decrease with increased temperature of synthesis, and the X-ray pattern changes slightly. The DTA curve shows endothermic peaks at 831, 954, and 1106 °C, and a major weight loss at 1000 °C. The infrared spectrum has absorption bands characteristic of an oxide.

The mineral occurs in quartz veins associated with bismuthinite, molybdenite, joseite, koechlinite, and cassiterite in a molybdenite deposit at Chilu, Fujian Province, China.

Discussion. The repository for type material is not given. Calculated d values are in only moderate agreement with the measured values, suggesting that the cell parameters (and inappropriate space-group possibilities) need revision. According to J.A. Mandarino, Chairman of the CNMMN-IMA, the new name that was approved was chilunite rather than chiluite. J.L.J.

Clinobehoite*

A.V. Voloshin, Ya.A. Pakhomovskii, D.L. Rogatshev, T.N. Nadezhina, D.Yu. Pustscharovskii, A.Yu. Bahkchisaraytsev (1989) Clinobehoite—A new natural modification of Be(OH)₂ from desilicated pegmatites. *Mineral. Zhurnal*, 11(5), 88–95 (in Russian).

Laser spectral analysis gave 55 ± 5 wt% Be, and coulometric analysis gave 41.0 wt% H₂O, corresponding to Be(OH)₂. Soluble in HCl. Cuneiform, platy crystals of the mineral occur in radial aggregates up to 1 mm in size. Thin plates are transparent. Color white, luster vitreous with pearly tint, $H = 2\text{--}3$, brittle, cleavages {100} perfect, {010} and {001} imperfect. $D_{\text{meas}} = 1.93(3)$, $D_{\text{calc}} = 1.92(2)$ g/cm³. The DTA curve shows an endotherm at 200–280 (maximum 240) °C, related to extensive release of water. The IR spectrum exhibits absorptions at 3545, 3485, 3405, 3320, 1235, 1175, 1115, 1005, 950, 820, 740, 710, 685, 635, 540, 525, 500, 465, and 440 cm⁻¹, analogous to those for synthetic αBe(OH)₂. Optically similar to behoite; biaxial negative, $\alpha = 1.539(1)$, $\beta = 1.544(1)$, $\gamma = 1.548(1)$, $2V_{\text{meas}} = 80^\circ$, $2V_{\text{calc}} = 83^\circ$. Strong dispersion, no pleochroism; $Y = b$, $X \approx c$, $Z \wedge a \approx 9^\circ$ (in obtuse angle β). Single-crystal X-ray study showed the mineral to be monoclinic, $a = 11.020(8)$, $b = 4.745(6)$, $c = 8.646(9)$ Å, $\beta = 98.94(8)^\circ$, space group $P2_1$, $Z = 12$. X-ray crystal-

structure refinement of the mineral is given. The strongest lines of the X-ray pattern (60 given) are: 5.43(80,200), 3.76(70,111), 3.61(90,300), 3.16(70,301), 2.714(100,400), and 2.306(70,113).

The mineral occurs in hydrothermally altered zones of desilicated pegmatites in the Murzinkha region (Ural Mts., USSR) and is associated with bavenite, bityite, phillipsite, analcime, and albite. The new name is for the monoclinic symmetry and chemical composition analogous to that of behoite. Type material is in the Fersman Mineralogical Museum, Moscow.

Discussion. Previously abstracted as an unnamed mineral in *Am. Mineral.*, 75, 1213, 1990. **J.P.**

Girvasite*

E.V. Sokolova, Yu.K. Egorov-Tismenko (1990) Crystal structure of girvasite. *Doklady Akad. Nauk SSSR*, 311(6), 1372–1376 (in Russian).

X-ray single-crystal structural study ($R = 0.049$) of girvasite indicated the formula $\text{NaCa}_2\text{Mg}_3(\text{OH})_2(\text{H}_2\text{O})_4[\text{PO}_4]_2[\text{PO}_2(\text{OH})_2](\text{CO}_3)$. The mineral is monoclinic, space group $P2_1/c$, $a = 6.522(3)$, $b = 12.25(3)$, $c = 21.56(2)$ Å, $\beta = 89.48(5)^\circ$, $D_{\text{meas}} = 2.46$, $D_{\text{calc}} = 2.42$ g/cm³ with $Z = 4$. Occurs in dolomitic carbonatite at the Kola Peninsula, USSR.

Discussion. As with tuliokite (which see), a complete description of the mineral has not yet been published. **J.L.J.**

Kazakhstanite*

E.A. Ankinovich, G.K. Bekenova, N.I. Podlipaeva (1989) A new hydrovanadate mineral kazakhstanite $\text{Fe}_3^+\text{V}_3^+\text{V}_{12}^{5+}\text{O}_{39} \cdot 8.55\text{H}_2\text{O}$ from a carbonaceous-siliceous formation in NW Karatau (southern Kazakhstan). *Zapiski Vses. Mineralog. Obshch.*, 118(5), 95–100 (in Russian).

Combined microprobe, wet chemical, and thermal analyses gave K_2O 0.14, CaO 0.09, Fe_3O_4 19.88, V_2O_4 12.88, V_2O_5 55.10, P_2O_5 0.17, H_2O^+ 12.50, sum 100.76 wt%, corresponding to $\text{Fe}_3^+\text{V}_3^+\text{V}_{12}^{5+}\text{O}_{39} \cdot 8.55\text{H}_2\text{O}$. The mineral forms small (0.01 mm) round or oval grains; aggregates, and aggregates with bokite, are up to 0.5×1.5 cm; occurs in thin anastomosing veins or as a cement in breccias. Black color, streak black with slight brownish tint, adamantine luster, dull in cryptocrystalline aggregates. $H_{10} = 62.69$ kg/mm² (Mohs = 2.5). Reflectance values of fine-grained aggregates (nm, R%): 440 16.4; 460 15.8; 480 15.0; 500 14.3; 520 13.6; 540 13.1; 560 12.8; 580 12.3; 600 12.1; 620 12.0; 640 12.0; 660 11.9; 680 11.8; 700 11.8; 720 11.7; 740 11.6. $D_{\text{meas}} = 3.4\text{--}3.6$, $D_{\text{calc}} = 3.52$ g/cm³ ($Z = 1$). Crystals are platy, largest faces {001}; perfect {001} cleavage. Soluble in cold acids. Melts at 630 °C. The IR spectrum has absorption bands at 470, 510, 715, 860, and 1000 cm⁻¹; diffuse absorption bands present

at 3460, 3230, and 1616 cm⁻¹ suggest that water in the mineral is weakly bonded. The DTA curve shows broad endotherms at 85–160, 370–490, 630 (melting), and 700 °C. The TG curve shows a continuous weight loss, and DTG exhibits maxima at 115 and 160 °C (corresponding losses are 5.55 and 2.20 wt%, respectively); the second loss is correlated with a series of weak, sharp endotherms that correspond to oxidation of low-valence vanadium. Total weight loss 13.50 wt%. Combined X-ray powder and SAD studies show the mineral to be monoclinic, $a = 11.84(1)$, $b = 3.6500(4)$, $c = 21.27(1)$ Å, $\beta = 100.0(1)^\circ$, space group $C2/c$ or Cc . Strongest lines of the powder pattern (15 given) are: 10.51(100,002), 3.484(60,110), 2.915(30,400), 2.756(30,115), and 2.606(40,311).

The mineral occurs in the weathered crust of vanadium-bearing black shales in northwestern Karatau, southern Kazakhstan, USSR. The name is for the locality. Type material is at the Fersman Mineralogical Museum, Moscow. **J.P.**

Lithiowodginite*

A.V. Voloshin, Ya.A. Pakhomovskii, A.Yu. Bakhchisaraitsev (1990) Lithiowodginite—A new mineral of the wodginite group from the granitic pegmatites of eastern Kazakhstan. *Mineral. Zhurnal*, 12(1), 94–100 (in Russian).

Electron-microprobe analysis (average of a few) gave: MnO 2.02, SnO_2 1.66, Ta_2O_5 85.06, Nb_2O_5 9.33, FeO 0.07, TiO_2 0.00, Li_2O 1.76, sum 99.90 wt%, corresponding to $(\text{Li}_{0.76}\text{Mn}_{0.18}\text{Fe}_{0.01})_{20.95}(\text{Ta}_{2.47}\text{Nb}_{0.45}\text{Sn}_{0.07})_{22.99}\text{O}_8$. The mineral forms the central parts (up to 5 mm) of red-brown wodginite (crystals up to several centimeters) and, at their contact, the wodginite is commonly replaced by ixiolite; irtyshite may also be present along the contact zone. The lithiowodginite is polysynthetically twinned, some containing relicts of simpsonite; color dark pink to red, translucent, streak pale pink, luster adamantine, fracture uneven, no cleavage, $H = 5\text{--}6$, $H_{40} = 1050$ kg/mm², $D_{\text{meas}} = 7.5(2)$, $D_{\text{calc}} = 7.74(1)$ g/cm³. No luminescence in UV and cathode rays. Optically similar to wodginite in reflected light: grayish white, no pleochroism, strongly anisotropic, bireflectance weak. Reflectance measurements (nm, R_1 , R_2 %): 486 14.1, 13.0; 553 14.0, 12.9; 589 14.3, 13.0; 656 14.0, 12.5. X-ray powder study showed the mineral to be structurally analogous to $\text{M-LiTa}_3\text{O}_8$ and wodginite; i.e., monoclinic, space group $C2/c$, $a = 9.441(3)$, $b = 11.516(4)$, $c = 5.062(2)$ Å, $\beta = 91.06^\circ$. The strongest lines of the powder pattern (52 given) are: 3.65(82,220), 2.987(100,221), 2.940(50,221), 2.502(38,041), and 1.709(32,441).

The mineral occurs in albitic zones of granitic pegmatites in eastern Kazakhstan, USSR. The new name is for the composition. Type material is at the Fersman Mineralogical Museum, Moscow. **J.P.**

Silicon*

M.I. Novgorodova, V.A. Boronikhin, M.E. Generalov, H. Kramer (1989) On native silicon in association with native gold and other metals. *Doklady Akad. Nauk SSSR*, 309(5), 1182–1185 (in Russian).

Electron-microprobe analysis of native silicon occurring in dioritic porphyries altered to sericite-quartz-carbonate rocks belonging to an ophiolitic complex at the Nuevo Potosi deposit, Cuba, gave Si 74.29, Au 21.39, Ag 2.49, O 1.84 [sum 100.01 wt%]. The small size of the analyzed grain resulted in incomplete resolution from the surrounding gold. Microprobe analysis of native silicon occurring in microbreccias that fill thin (0.1–1.0 mm) fissures in Archean plagiogneisses, at a depth of 10138–10182 m in the super-deep drillhole at the Kola Peninsula, USSR, gave 98.53 wt% Si.

The crystals of native silicon from Cuba (combination of cube and octahedron, <5 μm) occur in the central parts of high-purity gold grains (90–95 wt% Au). The latter are associated with prismatic crystals of arsenopyrite. Native silicon associated with native copper, lead, tin, nickel-bearing copper, and cohenite was also found in heavy-mineral concentrates collected in the mineralized parts of other ophiolitic complexes in the region.

The native silicon from the Kola Peninsula forms dodecahedral or cubic-octahedral crystals (10–80 μm) associated with graphite, moissanite, and native iron, or less frequently with native gold and zinc-bearing copper. The host breccias are cemented with fine-grained rock-forming minerals (plagioclase, biotite, muscovite, quartz) plus graphite, chalcedony-like quartz, sericite, and chlorite.

Discussion. Also reported to occur at several other localities, most recently in kimberlite pipes in the USSR (*Doklady Akad. Nauk*, 305, 704–707, 1989; *Mineralog. Zhurnal*, 12(3), 17–26, 1990). The new mineral and name were approved in 1983. J.P.

Scandium microlite

S. Bergstøl, G. Juve (1988) Scandian ixiolite, pyrochlore, and bazzite in granite pegmatite in Tørdal, Telemark, Norway. A contribution to the mineralogy and geochemistry of scandium and tin. *Mineral. Petrology*, 38, 229–243.

Electron-microprobe analysis of an altered area in ixiolite from Heftetjern, Tørdal, Norway, gave CaO 4.2, MnO 0.3, FeO 1.5, Sc₂O₃ 3.4, Y₂O₃ 3.6, SnO₂ 1.5, UO₂ 9.5, Ta₂O₅ 56.0, Nb₂O₅ 15.2, TiO₂ 2.0, F 1.5, O \equiv F 0.6, sum 98.1 wt%, corresponding to cation ratios of (Ca_{0.38}Mn_{0.02}Fe_{0.11}Sc_{0.25}Y_{0.16}Sn_{0.05}U_{0.18})_{21.15}(Ta_{1.29}Nb_{0.58}Ti_{0.13})_{22.00}. "... The species name *scandium microlite* is introduced since Sc exceeds 20% of the total A-atoms and is the most abundant A-atom other than Ca."

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

Strontio Piemontite*

P. Bonazzi, S. Menchetti, A. Palenzona (1990) Strontio-piemontite, a new member of the epidote group, from Val Graveglia, Liguria, Italy. *Eur. J. Mineral.*, 2, 519–523.

Electron-microprobe analyses of several crystals gave CaO 11.69 (range 10.47–13.21), SrO 13.45 (12.20–14.62), Al₂O₃ 17.56 (17.00–18.05), Fe₂O₃ 4.89 (4.29–5.66), Mn₂O₃ 12.93 (12.32–13.32), SiO₂ 34.27 (33.97–34.48), MnO 2.87, H₂O 1.72, sum 99.38 wt%; MnO/Mn₂O₃ was assumed on the basis of charge balance and site-occupancy refinement, and H₂O was calculated to give one H per formula unit. The composition corresponds to (Ca_{0.79}Mn_{0.21})_{21.00}(Sr_{0.68}Ca_{0.31})_{20.99}(Al_{1.81}Mn_{0.86}Fe_{0.32})_{22.99}Si₃O₁₁O(OH), simplified as CaSr(Al,Mn³⁺,Fe³⁺)₃Si₃O₁₁O(OH). The A(2) site, as determined by X-ray crystal-structural study ($R = 0.035$), is occupied mainly by Sr in strontio-piemontite and by Ca in piemontite. Occurs as prismatic crystals up to 0.5 mm long, elongate [010], deep red color, purple-brown streak, vitreous luster, transparent, perfect {001} cleavage, $H = 6$. $D_{\text{meas}} = 3.65\text{--}3.73$, $D_{\text{calc}} = 3.73$ g/cm³. Optically biaxial positive, refractive indices not determined, strongly pleochroic with $X = \text{yellow-orange}$, $Y = \text{violet}$, $Z = \text{reddish violet}$, $Y = b$. Monoclinic, space group $P2_1/m$, $a = 8.862(2)$, $b = 5.682(1)$, $c = 10.191(4)$ Å, $\beta = 114.70(1)^\circ$, as refined from a Guinier powder pattern (CuK α radiation) with strongest lines of 3.493(50,211), 2.916(100,113), 2.836(50,020), 2.678(40,120), 2.601(50,311), 2.117(40,223), and 1.590(50,331).

The mineral occurs in veinlets, 3–4 mm thick, which cut quartz-braunite manganese ore. Associated minerals in the veinlets are calcite, rhodochrosite, rhodonite, and ganophyllite. Type material is in the Museo di Mineralogia dell'Università di Firenze, Firenze, Italy. J.L.J.

Tuliokite*

N.A. Yanova, D.Yu. Pushcharovskii, A.V. Voloshin (1990) Crystal structure of tuliokite—A new sodium, barium, thorium carbonate. *Doklady Akad. Nauk SSSR*, 310(1), 99–102 (in Russian).

Single-crystal X-ray structural study ($R = 0.032$) of tuliokite from a pegmatite in nepheline syenite in the Khibiny alkaline massive, Kola Peninsula, USSR, indicated trigonal symmetry, space group, $R\bar{3}$, $a = 14.175(7)$, $c = 8.605$ Å. $D_{\text{meas}} = 3.15$, $D_{\text{calc}} = 3.25$ g/cm³ for Na₆BaTh(CO₃)₆·6H₂O with $Z = 3$.

Discussion. The name should not have been used prior to publication of a complete description of the mineral. J.L.J.

Yakhontovite*

V.P. Postnikova, S.I. Tsipurskij, G.A. Sidorenko, A.V. Mokhov (1986) Yakhontovite—A new copper-bearing smectite. *Mineralog. Zhurnal*, 8(6), 80–84 (in Russian).

Microprobe analysis gave SiO₂ 54.83, TiO₂ 0.00, Al₂O₃ 0.08, Fe₂O₃ 15.03, FeO 0.00, MgO 6.21, CaO 2.62, CuO 15.20, MnO 0.00, ZnO 0.40, Na₂O 0.00, sum 94.52 wt%, corresponding to Ca_{0.20}K_{0.01}(Fe_{0.83}³⁺Cu_{0.84}Mg_{0.67}Zn_{0.02}-Al_{0.01})_{22.37}[Si₄O₁₀(OH)₂. Wet-chemical analysis of impure material containing malachite and pseudomalachite showed all of the Fe to be trivalent and gave K₂O 0.11, H₂O 14.55. The presence of Cu in octahedral positions was proved by exchange of interlayer cations with NH₄. The mineral forms microcrystalline, pistachio-green aggregates easily polished with a knife; *H* = 2–3, conchoidal fracture. The aggregates adhere to wet surfaces, and disperse readily in water to form a persistent suspension. TEM study showed individual crystals of the mineral to be isometric (equant?) in habit, slightly elongate, and 0.1–10 μm in diameter. Optically biaxial, aggregates pleochroic in blue-green tints, positive elongation, *Z* ∧ *c* = 12–14°, α ≈ 1.530–1.545, γ ≈ 1.560–1.575. The infrared spectrum of the mineral is close to that of nontronite and has absorptions at 3705 and 3550 cm⁻¹. The DTA curve, similar to that of nontronite, exhibits endotherms at 150, 410 (weak), 600, and 700 °C; exotherms appear at 300 (weak) and 740 °C. X-ray and electron-diffraction studies showed the mineral to be probably monoclinic, *a* = 5.26, *b* = 9.108, *c** sin β = 14 Å. Strongest lines of the powder pattern are 13.9 (001), 7.30(002), 4.5(003,020), 3.2(004), and 2.88(005) Å. After treatment with glycerin and ethylene glycol, *d*₀₀₁ increases to 17.9 and 17.6 Å, respectively.

The mineral occurs, in deeply oxidized sulfide-cassiterite ores of the Komsomolsk region (Soviet Far East), as veins up to 0.5 cm and as coatings on leached spaces in pyrrhotite, chalcopyrite, pyrite, and stannite. Associated minerals are malachite, pseudomalachite, chrysocola, iron hydroxides, and quartz. The name is for the Russian mineralogist L.K. Yakhontova. Type material is at the Fersman Mineralogical Museum, Moscow, USSR. **J.P.**

Kingsaoite

Yuchun Zhen, Zhenheng Huang (1989) Kingsaoite—A variety of Co-rich willemite. *Acta Mineral. Sinica*, 9(1), 33–36 (in Chinese, English abstract).

The average of three electron-microprobe analyses gave ZnO 47.01, CoO 25.41, SiO₂ 27.36, [sum 99.78 wt%], corresponding to Zn_{1.26}CO_{0.74}Si_{1.00}O₄, ideally (Zn,CO)SiO₄. The mineral is dark blue-violet, *H*₁₀₀ = 548–681 kg/mm², optically bright blue to peach-red color, uniaxial positive, ε = 1.722–1.723, ω = 1.713–1.714, *D*_{meas} = 4.04–4.12 g/cm³. Grains are subhedral to euhedral, but mainly anhedral aggregates; some grains show a hexagonal pyramid, and crystal size is 0.012–0.027 mm. The X-ray powder pattern, similar to that of willemite, has strongest lines at 3.4986(100,220), 2.8428(100,113), 2.6389(100,140), 2.3220(60,330), 1.8620(60,330), 1.4220(80,713), and 1.3396 Å (50,090). Calculated cell parameters are *a* = 13.9559, *c* = 9.3364. The mineral occurs in the oxidized

zone of a gold deposit in argillaceous sandstone at Xingsao, Hunan Province, China.

Discussion. The mineral is recognized as a cobalt-bearing variety of willemite, and the inappropriate and unapproved name kingsaoite does not appear in the title or text of the version in Chinese. The title as given in Chinese can be translated as “Co-Zn silicate—A Co-rich variety of willemite.” **J.L.J.**

Unnamed MnSi, Mn

A.A. Kim, V.Yu. Pankov, Yu.M. Novoselov (1989) Native siliceous manganese in heavy-mineral associations of Central Aldan. *Doklady Akad. Nauk SSSR*, 308(3), 699–702.

Electron-microprobe analyses of poorly rounded grains (measuring 0.6–0.8 mm) consisting of an exsolved phase and its host gave, for the exsolved phase: Mn 86.94, Fe 5.23, Si 3.59, P 0.17, C 4.26, sum 100.19 wt% (one of three analyses), corresponding to (Mn,Fe)₃(C,Si); two analyses of the host gave Mn 87.26, 86.33, Fe 7.93, 7.12, Si 4.81, 5.97, P 0.35, 0.30, sum 100.35, 99.72 wt%. The results correspond to αMn or βMn according to the Mn-Si phase diagram.

Grains are steel-gray with a creamy tint; surfaces are rough-textured, like lizard skin. Luster metallic. The exsolved phase is platy to vermicular and is 1 × 5–10 μm to 2 × 20–30 μm. In reflected light the host phase is isotropic; the exsolved phase is weakly anisotropic and has a reflectance close to that of the host. Reflectance measurements (results identical for the host and exsolved phase; nm, *R*%): 420 54.1; 440 54.9; 460 55.8; 480 56.9; 500 57.8; 520 58.6; 540 59.2; 560 59.7; 580 60.1; 600 60.5; 620 61.0; 640 61.5; 660 61.9; 680 62.3; 700 63.0; 720 63.8; 740 64.4; 760 64.9. Microhardness 908–1095 kg/mm² (host), 1049 kg/mm² (exsolution phase). The host contains drop-like inclusions of tephroite. An X-ray pattern of a grain consisting of the host plus exsolved phase has strongest lines of 2.105(100), 1.998(90), 1.909(40), 1.691(30), and 1.170 Å (40).

The minerals occur in the nonmagnetic fraction of a heavy-minerals concentrate collected from alluvial deposits from the Tazeka, Malaja Yukhta, and Bolshaja Yukhta streams, Central Aldan, Siberia, USSR. **J.P.**

Ag_{1.5}Bi_{5.5}S₉, Ag_{3.5}Bi_{7.5}Si₁₃

W.G. Mumme (1990) A note on the occurrence, composition and crystal structures of pavonite homologous series members ⁴P, ⁶P, and ⁸P. *Neues Jahrb. Mineral. Mon.*, 193–204.

Electron-microprobe analysis (not given) of a specimen from Felbertal, Austria, gave the composition Cu_{0.11}-Ag_{0.80}Pb_{0.86}Bi_{5.01}S₉. Single-crystal X-ray study indicated monoclinic symmetry, *a* = 13.83, *b* = 4.40, *c* = 14.72 Å, β = 97.50°. An equivalent mineral, which coexists with hammarite in interstices in diopside and chondrodite,

occurs in a specimen from Baita Bihorului (formerly Rez-banya), Rumania. Single-crystal X-ray structural study and electron-microprobe analyses (not given) indicated an intergrowth of two closely related monoclinic (space group $C2/m$) phases, one with $a = 13.37$, $b = 4.05$, $c = 14.71$ Å, $\beta = 99.5^\circ$, and the other with $a = 13.37$, $b = 4.05$, $c = 14.96$ Å, $\beta = 100.5^\circ$. The major component has the composition $\text{Cu}_{1.12}\text{Ag}_{0.81}\text{Pb}_{0.27}\text{Bi}_{5.35}\text{S}_9$, and the other corresponds to $\text{Cu}_{1.69}\text{Ag}_{0.64}\text{Pb}_{0.66}\text{Bi}_{5.02}\text{S}_9$. The cell dimensions and compositions indicate that the three minerals are the equivalent of the pavonite homologue ^4P , ideally $(\text{Cu,Ag})_{1.5}\text{Bi}_{5.5}\text{S}_9$.

Electron-microprobe analysis of a grain in a specimen of berryite from the Mike mine, San Juan County, Colorado, gave Cu 3.54, Ag 10.76, Pb 12.56, Bi 54.82, S 17.40, sum 99.08 wt%, corresponding to $(\text{Cu}_{1.34}\text{Ag}_{2.39}\text{Pb}_{1.45}\text{Bi}_{6.29})_{\Sigma 11.47}\text{S}_{13}$, ideally $\text{Me}_{11}\text{S}_{13}$. Single-crystal X-ray structural study showed the grain to be twinned and to be monoclinic, space group $C2/m$, $a = 13.41$, $b = 4.05$, $c = 21.51$ Å, $\beta = 94.5^\circ$. Cell dimensions and composition are similar to those reported by Karup-Møller and Makovicky (*Program Abstr. 14th Gen. Mtg. IMA*, July 1986, Stanford California, p. 138) for Cu-rich and Cu-deficient phases from the Alaska Silver mine, Colorado. The Cu-rich phase corresponds to $\text{Ag}_{2.62}\text{Cu}_{1.64}\text{Pb}_{1.65}\text{Bi}_{6.14}\text{S}_{13}$, and the other corresponds to $\text{Ag}_{3.11}\text{Cu}_{0.58}\text{Pb}_{1.10}\text{Bi}_{6.69}\text{S}_{13}$; respective cell parameters are $a = 13.48$, $b = 4.06$, $c = 21.72$ Å, $\beta = 93.9^\circ$, and $a = 13.47$, $b = 4.06$, $c = 21.63$ Å, $\beta = 92.9^\circ$. All three phases correspond to the ^8P homologue of pavonite.

Discussion. ΣMe for the formulas by Karup-Møller and Makovicky (1986) are 12.05 and 11.48, respectively. The ^4P and ^8P phases are reported by the author to have been submitted to the CNMMN-IMA in 1986, but "to this stage their status has not been recognized or approved, although the nomenclatorial problems which were given as a reason for this delay have long been solved." J.L.J.

$\text{Ag}_9\text{SbTe}_2\text{S}_4$, $\text{Ag}_{10}\text{FeTe}_2\text{S}_4$

S. Karup-Møller, E. Makovicky, G. Pilström (1989) Mineralogy of the sulphosalt zone at the Långdal deposit, Boliden district, northern Sweden. *Neues Jahrb. Mineral. Abh.*, 160, 299–327.

Three electron-microprobe analysis of microscopic laths in galena gave Ag 65.84, 67.92, 67.23, Cu 0.01, 0.00, 0.01, Pb 0.07, 0.10, 0.05, Fe 0.08, 0.07, 0.07, Sb 8.81, 9.45, 9.05, As 0.07, 0.03, 0.05, Te 17.80, 15.31, 17.23, S 8.49, 9.67, 8.84, sum 101.18, 102.58, 102.55 wt%, approximating $\text{Ag}_{8.8}\text{Sb}_{1.0-1.1}\text{Te}_{1.9-2.0}\text{S}_{3.8-3.9}$, possibly $\text{Ag}_9(\text{Sb,As})\text{Te}_2\text{S}_4$. The formula is close to that of benleonardite $\text{Ag}_8(\text{Sb,As})\text{Te}_2\text{S}_{3.5}$, but the laths are too small to obtain X-ray data. In addition to the apparently homogeneous laths from which the above compositions were obtained, some laths are decomposition intergrowths consisting of the $\text{Ag}_9\text{SbTe}_2\text{S}_4$ phase with galena and lamellar to myrmekitic grains of a phase for which electron-microprobe analysis

gave Ag 71.80, Cu 0.02, Pb 0.12, Fe 3.61, Sb 0.76, As 0.01, Te 17.68, S 8.94, sum 102.94 wt%, corresponding to $\text{Ag}_{9.56}\text{Pb}_{0.01}\text{Fe}_{0.93}\text{Sb}_{0.05}\text{Te}_{1.99}\text{S}_{4.00}$, possibly $\text{Ag}_{10}\text{FeTe}_2\text{S}_4$. The minerals occur in the metamorphosed volcanogenic Långdal polymetallic sulfide deposit, southwest of Boliden in the Skellefte ore district, northeastern Sweden. J.L.J.

Unnamed (Ni,Fe,Co)AsS

M.Z. Abzalov, L.I. Polezhaeva (1989) Sulfoarsenides in rocks of productive beds of Pechenga (Kola Peninsula). *Zapiski Vses. Mineral. Obshch.*, 118(4), 64–73 (in Russian).

Microprobe analysis of an anisotropic mineral similar to arsenopyrite gave Fe 8.43, Co 8.66, Ni 13.24, As 48.63, S 18.41, sum 97.37 wt%, corresponding to $(\text{Ni}_{0.37}\text{Fe}_{0.25}\text{Co}_{0.24})_{\Sigma 0.86}\text{As}_{1.06}\text{S}_{0.94}$. The mineral occurs in the metasedimentary rocks of the Pechenga synclinorium (Kola Peninsula, USSR) and is associated with arsenopyrite, cobaltoan arsenopyrite, cobaltite, and gersdorffite.

Discussion. Apparently the nickel member of the arsenopyrite group. A more complete description is needed. J.P.

Ferric sulfate

Qiguang Wang, Wanmao Li (1988) Crystal structure of a new ferric sulfate mineral. *Kexue Tongbao*, 33(1), 1783–1787 (in English).

A ferric sulfate mineral of composition [no analysis given] $\text{Fe}_{3-x}(\text{SO}_4)_2 \cdot 14\text{H}_2\text{O}$ ($x \approx 0.33$) occurs with anhydrite in the oxidation zone of the Xitianshan mine, Qinghai Province, China. The mineral is light violet, turning dark red and amorphous on exposure to air. X-ray single-crystal structural study ($R = 0.026$) indicated triclinic symmetry, space group $P\bar{1}$, $a = 6.448(16)$, $b = 15.248(21)$, $c = 6.307(14)$ Å, $\alpha = 90.14(2)$, $\beta = 100.93(2)$, $\gamma = 94.12(2)^\circ$, $D_{\text{meas}} = 2.17$, $D_{\text{calc}} = 2.20$ g/cm³ with $Z = 1$. The absence of Fe^{2+} was confirmed by Mössbauer spectroscopy. J.L.J.

$\text{Ba}_3(\text{Ti}_{1.2}\text{Nb}_{4.8})\text{Si}_4\text{O}_{25.4}$

N.A. Yamnova, D.Yu. Pushcharovskii, A.V. Voloshin (1990) Crystal structure of a new barium niobium silicate. *Kristallografiya*, 35(2), 346–348 (in Russian).

X-ray crystal-structural study ($R = 0.040$) of a Ba-Nb silicate from carbonatite at Vuoriyarvi, Kola Peninsula, USSR, indicated hexagonal symmetry, space group $P\bar{6}2m$, $a = 9.03(1)$, $c = 7.868(6)$ Å. The formula from a chemical analysis [not given] is $\text{Ba}_3\text{TiNb}_4\text{Si}_4\text{O}_{25}$; the structural formula is $\text{Ba}_3(\text{Ti}_{1.2}\text{Nb}_{4.8})\text{Si}_4\text{O}_{25.4}$, $D_{\text{meas}} = 4.16$, $D_{\text{calc}} = 4.29$ g/cm³ with $Z = 1$. The synthetic analogue is $\text{Ba}_3\text{Nb}_4\text{Si}_4\text{O}_{26}$. J.L.J.

New Data**Rhönite**

E. Bonaccorsi, S. Merlino, M. Pasero (1990) Rhönite: Structural and microstructural features, crystal chemistry and polysomatic relationships. *Eur. J. Mineral.*, 2, 203–218.

X-ray crystal-structural study of rhönite from the Allende meteorite and from volcanic breccias at Scharnhausen, Germany, gave the following structural formulas:

Scharnhausen: $(\text{Ca}_{1.9}\text{Na}_{0.1})(\text{Mg}_{1.4}\text{Fe}_{0.6}^{2+})(\text{Mg}_{1.9}\text{Fe}_{1.1}^{3+})\text{Ti}_4(\text{Si}_3\text{Al}_3)\text{O}_{20}$

Allende: $\text{Ca}_2(\text{Mg}_{1.7}\text{Fe}_{0.3}^{2+})(\text{Mg}_{1.2}\text{Al}_{0.5}\text{V}_{0.3}\text{Ti}_{0.8}^{3+}\text{Ti}_{1.2}^{4+})(\text{Si}_2\text{Al}_2)\text{Al}_2\text{O}_{20}$

Other analyses: $(\text{Ca},\text{Na})_2(\text{Fe}^{2+},\text{Mg})_2(\text{Mg},\text{Fe}^{3+},\text{Ti}^{4+})_3(\text{Ti}^{4+}\text{Fe}^{3+})(\text{Si},\text{Al})_6\text{O}_{20}$

The general formula is $\text{Ca}_2(\text{MgFe}^{2+},\text{Fe}^{3+},\text{Ti})_6(\text{Si},\text{Al})_6\text{O}_{20}$, related to that of the aenigmatite group.

Discussion. The compositions, as written, indicate that more than a single name is merited. **J.L.J.**

Volborthite

M.A. Lafontaine, A. Le Bail, G. Férey (1990) Copper-containing minerals—1. $\text{Cu}_3\text{V}_2\text{O}_7(\text{OH})_2 \cdot 2\text{H}_2\text{O}$: The synthetic homolog of volborthite; crystal structure determination from X-ray and neutron data; structural correlations. *J. Solid State Chem.*, 85, 220–227.

X-ray and neutron powder-diffraction study of synthetic volborthite gave monoclinic symmetry, space group $C2/m$, $a = 10.604(4)$, $b = 5.874(1)$, $c = 7.213(3)$ Å, $\beta = 94.90(3)^\circ$ (X-ray). The determination of the specific space group is new. **J.L.J.**