American Mineralogist, Volume 81, pages 516–520, 1996

NEW MINERAL NAMES*

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Altisite*

A.P. Khomyakov, G.H. Nechelyustov, G. Ferraris, G. Ivaldi (1995) Altisite $Na_3K_6Ti_2Al_2Si_8O_{26}Cl_3$, a new mineral. Zapiski Vseross. Mineral. Obshch., 123(6), 90–95 (in Russian).

G. Ferraris, G. Ivaldi, A.P. Khomyakov (1995) Altisite $Na_3K_6Ti_2[Al_2Si_8O_{26}]Cl_3$ a new hyperalkaline aluminosilicate from Kola Peninsula (Russia) related to lemoynite: Crystal structure and thermal evolution. Eur. J. Mineral., 7, 537–546.

The mineral occurs as irregular, colorless grains to 3 mm in pegmatite in the southeastern part of the Khibiny massif, Kola Peninsula, Russia. Electron microprobe analysis of three grains gave Na_2O 9.3, K_2O 20.7, BaO 1.0, Al_2O_3 8.7, SiO_2 40.3, ZrO_2 0.1, TiO_2 13.1, Nb_2O_5 0.5, Cl 8.6, O ≡ Cl 1.9, sum 100.4 wt%, corresponding to $Na_3(K_{5.23}Na_{0.57}Ba_{0.08})(Ti_{1.95}Nb_{0.04}Zr_{0.01})Al_{2.03}Si_{7.98}O_{26.10}Cl_{2.89}$. Vitreous luster, $H = 6$, conchoidal fracture, no cleavage, nonfluorescent, unreactive with 10% HCl or HNO_3 at room temperature, $D_{meas} = 2.64(2)$, $D_{calc} = 2.67$ g/cm³ for $Z = 2$. Optically biaxial positive, $\alpha = 1.601(2)$, $\beta = 1.625(2)$, $\gamma = 1.654(2)$, $2V_{meas} = 85(1)$, $2V_{calc} = 86°$. The IR spectrum has strong absorption effects at 488, 520, 577, 590, 930, and 995 cm^{-1}. TGA showed steps at 250–300 and 800–900 °C, with total loss 2.5 wt% to 1000 °C. Turns bright light blue on heating to 600 °C, without change in optical or X-ray properties. Single-crystal X-ray structure study ($R = 0.025$) showed monoclinic symmetry, space group $C2/m$; $a = 10.37(1)$, $b = 16.32(3)$, $c = 9.16(2)$ Å, $\beta = 105.6(2)°$ from an X-ray powder pattern (114 mm camera, Fe$K\alpha$ radiation) with strongest lines of 8.22(71,020), 3.50(42,221,$\bar{2}$22), 3.049(100,132,$\bar{3}$12), 2.900(71,$\bar{3}$31,$\bar{2}$03), and 2.835(84,151). The structure is similar to that of lemoynite.

The mineral occurs mainly in interstices among pectolite grains in pegmatite intersected in an exploratory drillhole. The pegmatite contains sodalite, nepheline, potassium feldspar, pectolite, aegirine, shcherbakovite, tinaksite, arfvedsonite, nefedovite, villiaumite, natrite, and rasvumite. The new name alludes to the composition (Al-Ti-Si). Type material is in the Fersman Mineralogical Museum, Moscow, Russia, and in the Regional Museum of Natural History, Turin, Italy. **N.N.P.**

Chengdeite*

Zuxiang Yu (1995) Chengdeite—ordered natural iron-iridium alloy. Acta Geol. Sinica, 69(3), 215–220 (in Chinese, English abs.).

The mean and range of 13 electron microprobe analyses gave Fe 7.9 (6.4–8.4), Ni 0.03 (0.00–0.08), Co 0.03 (0.00–0.08), Cu 0.83 (0.76–0.91), Rh 0.19 (0.07–0.34), Pd 0.00 (0.00–0.04), Os 0.06 (0.00–0.22), Ir 88.5 (86.5–92.3), Pt 2.2 (0.1–3.6), S 0.001 (0.000–0.008), As 0.02 (0.00–0.15), sum 99.76 (99.30–100.06) wt%, corresponding to $(Ir_{2.926}Pt_{0.072}Rh_{0.012}Os_{0.002})_{\Sigma 3.012}(Fe_{0.899}Cu_{0.083}Ni_{0.003}Cu_{0.003})_{\Sigma 0.988}$, ideally Ir_3Fe. Occurs as grains to 0.5 mm associated with inaglyite, to 0.5 mm in graphic intergrowths with iridium, and to 20 μm in association with $(Fe,Ni,Cu)_2IrS_3$. Steel-black color, metallic luster, black streak, $H = 5$, $VHN_{50} = 452$ (411–467), malleable, strongly magnetic, $D_{calc} = 19.19$ g/cm³ for $Z = 1$. Bright white with a yellowish tint in reflected light, no bireflectance or pleochroism, isotropic. Reflectance percentages (WTiC standard, air) are given in 10 nm steps from 400 to 700 nm; representative values are 61.7 (400), 66.2 (470), 69.1 (540), 69.5 (550), 71.1 (590), 72.5 (650), and 72.8 (700). Strongest lines of the X-ray powder pattern (Fe$K\alpha$ radiation) are 2.18(80,111), 1.89(60,200), 1.34(70,220), 1.142(100,311), and 1.094 Å (80,222); by analogy with isoferroplatinum, which is the Pt analog, cubic symmetry, space group $Pm3m$, $a = 3.792(5)$.

The new mineral is associated with other PGM in placer concentrates from a branch of the Luanhe River in Chengde County (hence the new name), about 200 km NNE of Beijing; also reported to occur in chromite ore in ultramafic rocks. Type material is in the Geological Museum of China, Beijing. **J.L.J.**

Frankhawthorneite*

A.C. Roberts, J.D. Grice, A.J. Criddle, M.C. Jensen, D.C. Harris, E.A. Moffatt (1995) Frankhawthorneite, $Cu_2Te^{6+}O_4(OH)_2$, a new mineral species from the Centennial Eureka mine, Tinctic district, Juab County, Utah. Can. Mineral., 33, 641–647.

J.D. Grice, A.C. Roberts (1995) Frankhawthorneite, a unique HCP framework structure of a cupric tellurate. Can. Mineral., 33, 649–653.

The mineral occurs as elongate, green crystals, up to 0.1 mm long, isolated or as groups on drusy quartz in vugs in waste rock from the Centennial Eureka mine,

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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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which ceased production in 1927. Crystals are subhedral to euhedral, prismatic to stubby bladed, elongate [001], showing {010} and minor possible {100} and {011}. Leaf-green color, green streak, transparent, vitreous luster, brittle, uneven fracture, nonfluorescent, $H = 3–4$, $D_{calc} = 5.43$ g/cm³ for $Z = 2$. Pale gray in reflected light, weakly bireflectant, nonpleochroic, mean $n_{calc} = 2.00$. Electron microprobe analysis (average of five) gave CuO 45.20, TeO_3 48.77, H_2O (calc.) 5.05, sum 99.02 wt%, corresponding to $Cu_{2.03}Te^{6+}_{0.99}O_{4.00}(OH)_2$. The presence of OH was confirmed by IR spectroscopy and by single-crystal X-ray structure study ($R = 0.054$); the latter indicated monoclinic symmetry, space group $P2_1/n$. Cell dimensions refined from a 114 mm Debye-Scherrer powder pattern (Cu$K\alpha$ radiation) are $a = 9.095(3)$, $b = 5.206(2)$, $c = 4.604(1)$ Å, $\beta = 98.69(2)°$; strongest lines are 4.337(60, $\bar{1}01$), 3.838(50,101), 2.891(70,$\bar{2}11$), and 2.598(100,020, 310,211).

The new mineral is associated with mcalpineite and several Cu- and Te-bearing secondary minerals, including five unnamed ones. The new name is for F.C. Hawthorne of the University of Manitoba. Type material is in the Systematic Reference Series of the National Mineral Collection at the Geological Survey of Canada, Ottawa. **J.L.J.**

Gregoryite*

A.A. Church, A.P. Jones (1995) Silicate-carbonate immiscibility at Oldoinyo Lengai. J. Petrology, 36(4), 869–889.

Five electron-microprobe compositions, predominantly representative of microphenocrysts and phenocrysts (to 3 mm in diameter), are given for gregoryite $(Na,K,Ca)_2CO_3$.

Discussion. The name was introduced in 1980 (*Am. Mineral.*, 66, p. 879, 1981), was approved by the CNMMN in 1981, and is widely accepted by petrologists, but a full description seems not to have been published. **J.L.J.**

Kusachiite*

C. Henmi (1995) Kusachiite, $CuBi_2O_4$, a new mineral from Fuka, Okayama Prefecture, Japan. Mineral. Mag., 59, 545–548.

The mineral occurs as black prismatic crystals to 0.5 mm, and as platy grains in globular aggregates to 2 mm in diameter, on calcite crystals within a cavity in a calcite vein 2–8 cm in width. Opaque, metallic luster, perfect {110} cleavage, $H = 4.5$, $VHN_{25} = 292–357$, readily soluble in HCl, $D_{meas} = 8.5(3)$, $D_{calc} = 8.64$ g/cm³ for $Z = 4$. Gray in reflected light, deep red to dark brown internal reflection, weak but distinct bireflectance, pleochroic from brownish gray to gray with a faint bluish tint. Maximum and minimum reflectance percentages (SiC standard) in air are 21.1, 19.0 (482 nm), 20.2, 18.0 (545), 19.7, 17.6 (589), and 19.5, 17.3 (659); in oil ($n = 1.515$), 7.8, 6.5 (482), 7.1, 6.3 (545), 6.7, 5.8 (589), and 6.6, 5.5 (659). Electron microprobe analysis (mean of six) gave CuO 13.91, Bi_2O_3 86.00, sum 99.91 wt%, corresponding to $Cu_{0.960}Bi_{2.027}O_4$. Single-crystal X-ray study indicated tetragonal symmetry, space group $P4/ncc$, $a = 8.511(2)$, $c = 5.823(2)$ Å, in good agreement with data for the synthetic analog. Strongest lines of the powder pattern are 4.26(17,200), 3.191(100,211), 2.913(16,002), 2.695(18, 310), 2.404(13,202), and 1.947(18,411).

The host calcite vein occurs along the boundary between gehlenite-spurrite skarn and crystalline limestone. The new mineral, thought to be low-temperature hydrothermal in origin, is associated with henmilite, sillenite, bakerite, tenolite, bulfonteinite, apophyllite, cuspidine, and thaumasite. The new name is for I. Kusachi (b. 1942) of Okayama University. Type material is in the National Science Museum, Tokyo, Japan. **J.L.J.**

Owensite*

J.H.G. Laflamme, A.C. Roberts, A.J. Criddle, L.J. Cabri (1995) Owensite, $(Ba,Pb)_6(Cu,Fe,Ni)_{25}S_{27}$, a new mineral species from the Wellgreen Cu-Ni-Pt-Pd deposit, Yukon. Can. Mineral., 33, 665–670.

J.T. Szymánski (1995) The crystal structure of owensite, $(Ba,Pb)_6(Cu,Ni,Fe)_{25}S_{27}$, a new member of the djerfisherite group. Can. Mineral., 33, 671–677.

The mineral occurs as anhedral grains, to 43 × 110 μm, within pyrrhotite associated with magnetite, chalcopyrite, and pentlandite. Electron microprobe analysis (average of nine) gave Ba 23.04, Pb 3.58, Cu 25.33, Fe 20.24, Ni 0.25, S 27.11, Cl not detected, sum 99.55 wt%, corresponding to $(Ba_{5.42}Pb_{0.56})_{\Sigma 5.98}(Cu_{12.87}Fe_{11.70}Ni_{0.14})_{\Sigma 24.71}S_{27.31}$. Opaque, metallic luster, black streak, $H = 3½$, $D_{calc} = 4.78$ g/cm³ for $Z = 1$. In reflected light, pale brownish gray, tarnishes rapidly, isotropic; reflectance percentages in air and in oil, given in 20 nm steps from 400 to 700 nm, are 22.0, 9.95 (470), 24.9, 12.0 (546), 26.2, 13.0 (589), and 27.55, 13.9 (650). Single-crystal X-ray structure study ($R = 0.052$) indicated cubic symmetry, space group $Pm3m$, $a = 10.373(2)$ Å as refined from a 114 mm Gandolfi pattern (Cu$K\alpha$ radiation) with strongest lines of 3.460(40,300), 3.281(40,310), 2.996(90,222), 2.378(90, 331), 1.835(100,440), and 1.779(40,433).

The new name is for D.R. Owens (b. 1934) of the Canada Centre for Mineral and Energy Technology. The mineral occurs in the Wellgreen deposit, Kluane district, southwestern Yukon, in gabbro and peridotite containing Cu-Ni sulfides and PGM. The host ultramafic complex has unusually high concentrations of Ba, and contains barite and Ba-bearing feldspars. Type owensite is in the Geological Survey of Canada, Ottawa, and in the Natural History Museum, London, U.K. **J.L.J.**

Rimkorolgite*

S.N. Britvin, Ya.A. Pakhomovsky, A.N. Bogdanova, A.P. Khomyakov, N.I. Krasnova (1995) Rimkorolgite

$(Mg,Mn)_5(Ba,Sr,Ca)(PO_4)_4 \cdot 8H_2O$—a new mineral from the Kovdor iron deposit, Kola Peninsula. Zapiski Vseross. Mineral. Obshch., 124(1), 90–95 (in Russian).

The mean of two electron microprobe analyses gave MgO 26.55 (26.3–26.8), MnO 1.55 (1.5–1.6), CaO 0.1 (0.1–0.1), SrO 1.8 (1.8–1.8), BaO 16.95 (16.6–17.3), P_2O_5 36.25 (36.2–36.3), H_2O (Penfield method) 17.5, sum 100.70 wt%, corresponding to $(Mg_{5.05}Mn_{0.17})_{\Sigma 5.22}(Ba_{0.85}Sr_{0.13}Ca_{0.01})_{\Sigma 0.99}P_{3.92}O_{16} \cdot 7.45H_2O$, ideally $Mg_5Ba(PO_4)_4 \cdot 8H_2O$. Occurs as yellow-brown to light pink pseudohexagonal prismatic crystals to 0.02 × 0.03 × 0.07 mm, elongate [010], showing {001}, {010}, and {101}, with {001} ∧ {101} = 125.2(5)°; also as fibrous pseudomorphs after bobierrite, and as crusts in which crystals are 0.0*n* mm. Transparent to translucent, white streak, brittle, vitreous luster (silky for fibrous aggregates), $H = 3$, perfect {001} cleavage, soluble in 10% HCl, $D_{meas} = 2.67(2)$, $D_{calc} = 2.647$ g/cm³ for $Z = 4$. DTA showed endothermic effects at 120 and 220 °C (water loss), and a weak one at 690 °C (oxidation of Mn^{2+}). Optically biaxial positive, $\alpha = 1.552(2)$, $\beta = 1.552(2)$, $\gamma = 1.558(2)$, $2V = 23(5)°$, $X = c$, $Y = a$, $Z = b$. Single-crystal X-ray study (rotation method) indicated orthorhombic symmetry, space group *Pcmm*, *Pcm*2, or *Pc*2*m*; $a = 12.829(4)$, $b = 8.335(2)$, $c = 18.312(3)$ Å as refined from a diffractometer pattern (Cu*Kα* radiation; 54 lines given) with strongest lines of 10.51(100,101), 3.874(32,302,121), 3.520(34,105), 3.081(78,024), 3.054(41,006), 2.969(44,215,106), 2.839(34,403,322), and 2.089(30). Syntactic intergrowths with a hexagonal dimorph ($a = 22.36$ or possibly 11.18 Å) are present in 15–20% of the grains.

The mineral occurs in centimeter-size cavities in dolomitic carbonatites that cut jacupirangite and forsterite-magnetite ores containing collinsite, bobierrite, carbonate-fluorapatite, and strontiowhitlockite. The new name is for mineralogist *Rim*skaya-*Kor*sakova, *Olg*a (1914–1987). Type material is in the Mineralogical Museum of the St. Petersburg Mining Institute, and in the Mineralogical Museum of the Mineralogical Chair of St. Petersburg University, Russia. **N.N.P.**

Takedaite*

I. Kusachi, C. Henmi, S. Kobayashi (1995) Takedaite, a new mineral from Fuka, Okayama Prefecture, Japan. Mineral. Mag., 59, 549–552.

The mineral occurs as white to pale gray grains, up to 0.8 mm long and 0.3 mm wide, that are present as aggregates in the center of a vein of borate minerals along the boundary between crystalline limestone and skarn. Wet-chemical analysis gave CaO 71.13, B_2O_3 28.41, LOI (900 °C) 0.14, sum 99.68 wt%, corresponding to $Ca_{3.053}B_{1.965}O_6$, ideally $Ca_3B_2O_6$. Vitreous luster, $H = 4\frac{1}{2}$, $VHN_{25} = 478$ (429–503), $D_{meas} = 3.10(2)$, $D_{calc} = 3.11$ g/cm³ for $Z = 6$; easily soluble in dilute HCl. Colorless in transmitted light, uniaxial negative, $\omega = 1.726$, $\epsilon = 1.630$. Single-crystal X-ray study indicated trigonal symmetry, space group *R*3*c* or $R\bar{3}c$; $a = 8.638(1)$, $c = 11.850(2)$ Å as refined from a diffractometer pattern (Cu*Kα* radiation) with strongest lines of 2.915(100,113), 2.756(61,104), 2.493(44,300), and 1.895(75,223), in good agreement with data for the synthetic analog.

The new name is for Hiroshi Takeda (b. 1934) of the Mineralogical Institute, University of Tokyo. Takedaite is partly altered to frolovite and an unidentified mineral; associated hydrous borates such as nifontovite, olshanskyite, pentahydroborite, and sibirskite are thought to have formed by the hydration of takedaite. Type material is in the National Science Museum, Tokyo, Japan. **J.L.J.**

Wupatkiite*

S.A. Williams, F.P. Cesbron (1995) Wupatkiite from the Cameron uranium district, Arizona, a new mineral of the halotrichite group. Mineral. Mag., 59, 553–556.

The mineral occurs as cross-fiber veinlets that formed as a post-mining oxidation product on the walls of a shallow open cut near Gray Mountain, Coconino County, Arizona. Fibers are 5–10 μm in diameter, but up to 8 mm long; rose color, white streak, $H = 1\frac{1}{2}$ for masses, $G = 1.92$, $D_{calc} = 1.87$ g/cm³. Pale pink in transmitted light, with pleochroism indicated by slightly stronger coloring parallel to the fiber length; $n_g = 1.484$, $n_p = 1.477$; Z ∧ fiber length is up to 12°. Wet-chemical analysis gave CoO 3.41, MgO 1.63, NiO 0.52, MnO 0.17, FeO 0.15, CaO 0.10, CuO 0.12, Al_2O_3 11.30, SO_3 35.97, H_2O 42.26, sum 95.63 wt% (plus insoluble quartz and montmorillonite), corresponding to $(Co_{0.424}Mg_{0.376}Ni_{0.065}Mn_{0.022}Fe_{0.019}Ca_{0.017}Cu_{0.014})_{\Sigma 0.937}Al_{2.063}(SO_4)_{4.181} \cdot 21.83H_2O$, simplified as $(Co,Mg)Al_2(SO_4)_4 \cdot 22H_2O$, which is the Co analog of halotrichite. By analogy with halotrichite, symmetry is monoclinic, space group $P2_1/c$; refinement from the X-ray powder pattern gave $a = 6.189(4)$, $b = 24.234(10)$, $c = 21.204(10)$ Å, $\beta = 100.33(5)°$. Strongest lines are 6.03(22,023), 4.790(100,024), 4.295(27,140), 3.945(26,025), 3.768(33,062), and 3.494(92,124,063).

The mineral is associated with pickeringite and moorhouseite derived by oxidation of sooty black U-Co-Ni-Mo material that cements grits of the Chinle Formation. The new name is derived from the prehistoric dwelling Wupatki, near the discovery site of the mineral. Type material is in the Ecole Nationale Superieure des Mines, Paris, France. **J.L.J.**

$(Rh,Cu)_3S_2$, $(Ir,Rh)_3(Ni,Fe,Cu)_2S_3$

G. Garuti, M. Gazzotti, J. Torres-Ruiz (1995) Iridium, rhodium, and platinum sulfides in chromitites from the ultramafic massifs of Finero, Italy, and Ojén, Spain. Can. Mineral., 33, 509–520.

Cuprorhodsite, cuproiridsite, and other PGM occur as inclusions up to 12 μm in chromite from ultramafic massifs at Finero, Italy, and Ojén, Spain. Among the minerals is a weakly anisotropic, bluish gray, single grain of composition $(Ir_{0.34}Rh_{0.23}Cu_{0.18}Ni_{0.10}Fe_{0.11})_{\Sigma 0.96}S_{1.03}$ that is tentatively identified as xingzhongite; also present are a grain corresponding to $(Pt_{0.72}Rh_{0.43}Ir_{0.12}Pd_{0.01})_{\Sigma 1.28}Cu_{0.64}S_{3.06}$ or X_2S_3, and the following:

$(Rh,Cu)_3S_2$

Electron microprobe analyses of two grains from Finero, after recalculation for the presence of chromite and pentlandite, gave compositions corresponding to $(Rh_{1.92}Pd_{0.24}Ir_{0.11}Ru_{0.05}Cu_{0.64})_{\Sigma 2.96}S_{2.04}$, and $(Rh_{1.58}Pd_{0.11}Ir_{0.12}Ru_{0.17}Cu_{0.97})_{\Sigma 2.95}S_{2.12}$. Anhedral, white-gray, probably isotropic.

$(Ni,Fe,Cu)_2(Ir,Rh)S_3$

Several grains corresponding to (Ni,Fe,Cu,Ir,Rh)S have been observed at Finero and Ojén. The stoichiometry $(Ni,Fe,Cu)_2(Ir,Rh)S_3$ is suggested. Distinctly anisotropic, gray to bluish gray color, less reflective than millerite and pentlandite.

Discussion. The mineral abstracted as $(Pd,Rh)_{2+x}(Cu,Fe)_{1-x}S_2$ in *Am. Mineral.*, 76, p. 1439 (1991) could be the Pd analog of $(Rh,Cu)_3S_2$. For (Ni,Fe,Cu,Ir,Rh)S, see also *Am. Mineral.*, 79, 1211–1212 (1994). The mineral $(Fe,Ni,Cu)_2IrS_3$ is reported to be associated with chengdeite (abstract, this series). **J.L.J.**

$Bi_3(Te,Se,S)_4$

M. Shimizu, S.T. Schmidt, C.J. Stanley, K. Tsunoda (1995) Kawazulite and unnamed $Bi_3(Te,Se,S)_4$ in Ag-Bi-Te-Se-S mineralization from the Suttsu mine, Hokkaido, Japan. Neues Jahrb. Mineral. Abh., 169, 305–308.

The mineral occurs as anhedral grains, to 100 μm, intergrown with kawazulite, cassiterite, and selenian bismuthinite. Weakly to moderately bireflectant in reflected light, with pleochroism grayish white to creamy white; distinctly anisotropic; polarization colors dark gray to dark gray with bluish and brownish tints. Electron microprobe analysis gave Bi 63.3, 62.7, 62.2, Te 24.3, 21.5, 28.0, Se 10.1, 13.1, 5.2, S 2.7, 2.3, 3.6, sum 100.4, 99.6, 99.0 wt%, corresponding to $Bi_{3.002}(Te_{1.890}Se_{1.268}S_{0.840})_{\Sigma 3.998}$, $Bi_{2.979}(Te_{1.670}Se_{1.651}S_{0.700})_{\Sigma 4.021}$, and $Bi_{2.991}(Te_{2.205}Se_{0.667}S_{1.138})_{\Sigma 4.010}$. **J.L.J.**

Cu-Al, Cd-Al phosphates

M.C. Jensen, J.C. Rota, E.E. Foord (1995) The Gold Quarry mine, Carlin trend, Eureka County, Nevada. Mineral. Record, 26, 449–469.

Numerous well-crystallized rare minerals, including the possible Mg analog of burangite and the Fe analog of phosphofibrite, occur in the Gold Quarry open-pit mine. The assemblage also contains two additional unidentified, probably new, phosphates.

Cu-Al phosphate

Occurs as isolated spherules and as druses of pale green to deep turquoise-blue acicular radiating crystals. Probable formula $Cu(Al,V,Fe)_5(PO_4)_4(F,OH)_5 \cdot 7H_2O$, with the blue variety containing about 8 wt% F, and the green containing about 2.5 wt%. Optically biaxial negative, $\alpha = 1.540$, $\beta = 1.548$, $\gamma = 1.553$ (slightly lower for the green variety), $2V = 76°$, $r < v$, strong; X = pale greenish blue, Y = paler greenish blue, Z = blue. Single-crystal X-ray study indicated triclinic symmetry, pseudoorthorhombic, $a = \sim 12.10$, $b = \sim 18.95$, $c = \sim 4.94$ Å.

Cd-Al phosphate

A (Cd,Cu)-Al-(F,OH) phosphate of uncertain formula. Occurs with hewettite and opal as vitreous, blue, acicular crystals in radiating sprays to 3 mm. Optically biaxial positive, $\alpha = 1.570$, $\beta = 1.573$, $\gamma = 1.578$, $2V = 30°$, $r < v$ (strong). Triclinic symmetry, multiply twinned on {010}. Strongest lines of the X-ray powder pattern are 9.50(100,), 6.15(45), 4.75(50), 3.85(40), 3.67(35), 3.15(40), 2.90(40), and 2.80 Å (40). **J.L.J.**

New Data

Achtarandite, protoachtarandite

E. Galuskin, I. Galuskina, A. Winiarska (1995) Epitaxy of achtarandite on grossular—the key to the problem of achtarandite. Neues Jarhrb. Mineral. Mon., 306–320.

Achtarandite, named in 1790, is a pseudomorph after an unknown precursor referred to here as protoachtarandite. Protoachtarandite crystals were formed by epitaxial growth on grossular during contact metamorphism, and were then converted to hydrogarnet. Thus, achtarandite consists of hydrogarnet, and it is suggested that the precursor (i.e., protoachtarandite) was mayenite.

Discussion. The study is an attempt to decipher the nature of the pseudomorphs rather than to validate the name, which has long been discredited and is referred as achtaragdite in *Hey's Mineral Index* (third edition, 1995). **J.L.J.**

Borcarite

P.C. Burns, F.C. Hawthorne (1995) Hydrogen bonding in borcarite, an unusual borate-carbonate mineral. Mineral. Mag., 59, 297–304.

Single-crystal X-ray structure study ($R = 0.025$) confirmed that borcarite is monoclinic rather than triclinic, $a = 17.840(4)$, $b = 8.380(2)$, $c = 4.445(1)$ Å, $\beta = 102.04(3)°$, space group $C2/m$, $D_{calc} = 2.790$ g/cm³, $Z = 2$. **J.L.J.**

Claringbullite

P.C. Burns, M.A. Cooper, F.C. Hawthorne (1995) Claringbullite: A Cu^{2+} oxysalt with Cu^{2+} in trigonal-prismatic coordination. Can. Mineral., 33, 633–639.

Single-crystal X-ray structure study ($R = 0.034$) of claringbullite from Bisbee, Arizona, indicated hexagonal symmetry, space group $P6_3/mmc$, $a = 6.6733(5)$, $c = 9.185(1)$ Å, $D_{calc} = 3.882$ g/cm³ for $Z = 2$ and the new formula $Cu_4Cl[(OH)_{0.71}Cl_{0.29}](OH)_6$; the end-member composition is $Cu_4(OH)_7Cl$, and it is suggested that there is solid solution to $Cu_4(OH)_6Cl_2$. The latter can be simplified as $Cu_2(OH)_3Cl$, which would be another polymorph of paratacamite. **J.L.J.**

Edenharterite

P. Berlepsch (1995) Chemical and crystallographical investigations on edenharterite ($TlPbAs_3S_6$). Schweiz. Mineral. Petrogr. Mitt. 75, 277–281.

Electron microprobe analyses of edenharterite showed that Sb is consistently present in amounts from 1 to 2.7 wt%, but no correlation between As and Sb was observed. Single-crystal X-ray structure study gave good agreement with the results for synthetic Sb-free $TlPbAs_3S_6$, which is orthorhombic, space group $F2dd$. Thus, edenharterite is distinct from the new mineral $TlPbAs_2SbS_6$ (IMA 93-025), which is monoclinic, space group $P2_1/n$. **J.L.J.**

Ganomalite, molybdophyllite

G. Charalampides (1994) Mineralogical and crystal-chemical data of the lead silicate species ganomalite, margarosanite, and molybdophyllite from Långban, south-central Sweden and their synthetic equivalents. Mineral Wealth, 91, 33–46.

Ganomalite

Synthesis of ganomalite, $Pb_9Ca_5MnSi_9O_{33}$, has shown that incorporation of Mn is temperature dependent and that a Mn-free phase can be produced. Electron microprobe analyses of eight samples of ganomalite from Långban, Sweden, gave compositions extending from $Pb_{9.06}Ca_{5.55}Mn_{0.50}Si_{8.94}O_{33}$ to $Pb_{9.03}Ca_{5.00}Mn_{1.29}Si_{8.85}O_{33}$.

Molybdophyllite

Electron microprobe analysis of two samples from Långban gave PbO 59.47, 50.94, BaO 0.25, 0.41, CaO 0.01, 0.00, MnO 0.18, 0.53, MgO 11.94, 15.58, Al_2O_3 0.32, 0.64, SiO_2 18.25, 24.31, Cl 0.00, 0.07, sum 90.42, 92.59 wt%; 8% weight loss on heating. The respective tentative formulas are $Pb_{7.9}(Mg_{8.8}Mn_{0.1}Al_{0.2})Si_{9.0}O_{24}(OH)_{21.8}$ and $Pb_{5.2}Ba_{0.1}(Mg_{8.5}Mn_{0.2}Al_{0.3})Si_{9.0}O_{24}(OH)_{16.3}Cl_{0.1}$, possibly ideally $Pb_9Mg_9Si_9O_{24}(OH)_{24}$. Single-crystal X-ray study indicated hexagonal symmetry, $a = 9.32(2)$, $c = 27.39(7)$ Å, $Z = 2$.

Electron microprobe analysis of a mineral similar in appearance to molybdophyllite gave PbO 70.92, BaO 0.13, CaO 0.01, MnO 0.03, MgO 7.98, Al_2O_3 0.35, SiO_2 12.42, Cl 0.07, F 0.05, sum 91.96 wt%, corresponding to "18 Å molybdophyllite" with Pb:Mg:Si 3:2:2 and hexagonal cell parameters $a = 9.34$, $c = 36.79$ Å. **J.L.J.**

Kawazulite

M. Shimizu, S.T. Schmidt, C.J. Stanley, K. Tsunoda (1995) Kawazulite and unnamed $Bi_3(Te,Se,S)_4$ in Ag-Bi-Te-Se-S mineralization from the Suttsu mine, Hokkaido, Japan. Neues Jahrb. Mineral. Abh., 169, 305–308.

Electron microprobe analysis of kawazulite from the Suttsu mine gave Bi 58.9, Te 25.9, Se 12.9, S 1.9, sum 99.6 wt%, corresponding to $Bi_{2.011}(Te_{1.423}Se_{1.146}S_{0.421})_{\Sigma 2.990}$. The results indicate an ideal formula of $Bi_2(Te,Se,S)_3$ rather than $Bi_2Te_2(Se,S)$. **J.L.J.**

Olivenite

P.C. Burns, F.C. Hawthorne (1995) Rietveld refinement of the crystal structure of olivenite: A twinned monoclinic structure. Can. Mineral., 33, 885–888.

Rietveld refinement ($R = 0.06$) of olivenite, $Cu_2AsO_4(OH)$, showed it to have monoclinic rather than orthorhombic symmetry; space group $P2_1/n$, $a = 8.5894(2)$, $b = 8.2073(2)$, $c = 5.9285(1)$ Å, $\alpha = 90.088(3)°$. Reexamination of previous structure data for libethenite, the P analog of olivenite, suggests that it too may be monoclinic. **J.L.J.**

Tungusite

G. Ferraris, A. Pavese, S.V. Soboleva (1995) Tungusite: new data, relationship with gyrolite and structural model. Mineral. Mag., 59, 535–543.

Electron and X-ray diffraction study indicated that tungusite is triclinic, space group $P\bar{1}$, $a = 9.714(9)$, $b = 9.721(9)$, $c = 22.09(3)$ Å, $\alpha = 90.13(1)$, $\beta = 98.3(2)$, $\gamma = 129.0(1)°$, $Z = 1$. The ideal formula is $[Ca_{14}(OH)_8](Si_8O_{20})(Si_8O_{20})_2[Fe^{2+}_9(OH)_{14}]$, simplified as $Ca_{14}Fe_9Si_{24}O_{60}(OH)_{22}$. Forms a solid-solution series in which the Fe in tungusite is replaced by Ca in gyrolite. **J.L.J.**