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NEW MINERAL NAMES*

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Abswurmbachite*

T. Reinecke, E. Tillmanns, H.-J. Bernhardt (1991) Abswurmbachite, $Cu^{2+}Mn_6^{3+}[O_8/SiO_4]$, a new mineral of the braunite group: Natural occurrence, synthesis, and crystal structure. Neues Jahrb. Mineral. Abh., 163, 117–143.

The new mineral and cuprian braunite occur in brownish red piemontite-sursassite quartzites at Mount Ochi, near Karystos, Evvia, Greece, and in similar quartzites on the Vasilikon mountains near Apikia, Andros Island, Greece. An electron microprobe analysis (Andros material; one of six for both localities) gave SiO_2 9.8, TiO_2 0.61, Al_2O_3 0.60, Fe_2O_3 3.0, Mn_2O_3 71.3, MgO 0.04, CuO 12.5, sum 97.85 wt%, corresponding to $(Cu^{2+}_{0.93}Mn^{2+}_{0.06}Mg_{0.01})_{\Sigma 1.00}(Mn^{3+}_{5.58}Fe^{3+}_{0.23}Al_{0.07}Ti^{4+}_{0.04}Cu^{2+}_{0.05})_{\Sigma 5.98}Si_{1.02}$ for eight cations, ideally $CuMn_6SiO_{12}$, the Cu analogue of braunite. The range of Cu^{2+} substitution for Mn^{2+} is 0–42 mol% in cuprian braunite and 52–93 mol% in abswurmbachite. Occurs mostly as fibrous to elongate prismatic grains 6–50 μm long and 1–5 μm in diameter, and as subhedral equant grains 5–30 μm in diameter, both in quartz. Opaque, black color, brownish black streak, metallic luster, brittle, VHN_{25} = 920(50) for synthetic material, D_{calc} = 4.96 g/cm³ (synthetic material). In reflected light, gray, weak anisotropy, nonpleochroic, no internal reflection. Reflectance values (synthetic; SiC standard) for R_1 and R_2 in air are 470 20.8, 21.2; 546 19.6, 20.0; 589 19.2, 19.7; 650 18.7, 19.2; in oil 470 7.54, 7.88; 546 6.87, 7.16; 589 6.56, 6.92; 650 6.24, 6.58.

Single-crystal X-ray study of hydrothermally synthesized material gave powder patterns similar to that of braunite, and a Gandolfi pattern of natural material (0.62 Cu pfu) showed only the strongest braunite-type reflections at 2.70, 2.13, 1.66, and 1.41 Å. Strongest lines of synthetic material (0.98 Cu pfu) are 2.702(100,224), 2.350(15,040), 2.133(15,235), 1.6507(30,048), 1.4159(14,264), and 1.4016(11,2.2.12), from which a = 9.406(1), c = 18.546(3), tetragonal symmetry, space group $I4_1/acd$, Z = 8. Substitution of Mn^{2+} by Cu^{2+} results in a linear decrease in c and a nonlinear decrease in a. The infrared spectrum is similar to that of braunite.

The mineral occurs in low-grade, high-pressure metamorphosed Mn-rich quartzites in association with quartz, shattuckite, tenorite, sursassite, piemontite, ardennite, rutile, hollandite, and manganoan cuprian clinochlore. The new name is for Irmgard Abs-Wurmbach, in recognition of her contribution to the crystal chemistry, stability relations, and physical properties of braunite. Type material is in the Smithsonian Institution, Washington, DC, and in the Institut für Mineralogie, Ruhr-Universität Bochum, Germany. **J.L.J.**

Barstowite*

C.J. Stanley, G.C. Jones, A.D. Hart (1991) Barstowite, $3PbCl_2 \cdot PbCO_3 \cdot H_2O$, a new mineral from Bounds Cliff, St. Endellion, Cornwall. Mineral. Mag., 55, 121–125.

Electron microprobe and CHN analysis gave Pb 75.47, Cl 18.67, C 1.12, H 0.18, O (calc.) 6.03, sum 101.46 wt%, which for 17 atoms corresponds to $Pb_{4.02}Cl_{5.82}C_{1.03}H_{1.97}O_{4.16}$, simplified as $3PbCl_2 \cdot PbCO_3 \cdot H_2O$. The mineral occurs as subparallel, elongate intergrown crystals (0.2–0.5 mm) in aggregates up to 3 mm. Color and streak white, luster adamantine, brittle, uneven fracture, imperfect prismatic cleavage, transparent, VHN_{100} = 111 (108–117), H = 3, D_{meas} = 5.50–5.69, D_{calc} = 5.77 g/cm³ with Z = 2. In reflected light, moderately bireflectant from gray to dark gray, moderate anisotropy, colorless internal reflection. Reflectance values are given in 20-nm steps (SiC standard); representative values for R_1 and R_2 in air and in oil, respectively, are 470 13.5, 14.0, 3.02, 3.31; 546 12.9, 13.35, 2.76, 3.02; 589 12.65, 13.1, 2.67, 2.92; 650 12.4, 12.8, 2.60, 2.85. Color values for R_1, R_2 (illuminant C, air) are Y% 12.9, 13.3; λ_d 477, 476; P_e% 3.5, 3.7. The infrared spectrum is similar to that of phosgenite. X-ray single-crystal study indicated monoclinic symmetry, space group $P2_1$ or $P2_1/m$, a = 4.218(2), b = 9.180(2), c = 16.673(4) Å, β = 91.49(3)° as refined from a 114.6-mm Debye-Scherrer pattern (Fe radiation). Strongest lines of the powder pattern are 4.16(50,004), 4.02(100,022), 2.377(60,007,026), 2.296(80,040,12$\bar{5}$,106), and 2.108(40,200).

The mineral occurs in cavities with phosgenite in a vein, 15 cm wide, containing quartz, dolomite, galena, and minor cerussite, pyrite, sphalerite, chalcopyrite, and jamesonite, at Bounds Cliff, Cornwall, England. The exposed part of the vein is at water level, and the new mineral probably formed by reaction with seawater. The new name is for Richard William Barstow (1947–1982), Cornish mineral dealer. The type specimen is in the British Museum (Natural History), London. **J.L.J.**

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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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Coombsite*

T. Sameshima, Y. Kawachi (1991) Coombsite, Mn analogue of zussmanite, and associated Mn-silicates, parsettensite and caryopilite, from southeast Otago, New Zealand. New Zealand Jour. Geol. Geophys., 34, 329–335.

Electron microprobe analyses gave SiO_2 45.18, TiO_2 0.01, Al_2O_3 3.59, Fe as FeO 3.28, MnO 38.19, MgO 1.08, CaO 0.03, Na_2O 0.08, K_2O 2.19, sum 93.63 wt%, corresponding to $(K_{1.01}Na_{0.06})_{\Sigma 1.07}(Mn_{11.75}Fe_{1.00}Mg_{0.58})_{\Sigma 13.33}$-$(Si_{16.41}Al_{1.54})_{\Sigma 17.95}O_{42}(OH)_{14}$, ideally $KMn_{13}(Si,Al)_{18}O_{42}$-$(OH)_{14}$, the Mn analogue of zussmanite. Occurs as brown patchy aggregates, a few millimeters in diameter, commonly showing semispherulitic texture consisting of fibrolamellar crystals up to 20 μm long. $D_{meas} = 3.0(1)$, $D_{calc} = 3.063$ g/cm^3 with $Z = 3$. Optically pale yellowish brown, uniaxial negative, length slow, $\epsilon = 1.600(1)$, $\omega = 1.619(1)$, very weakly pleochroic with $\omega > \epsilon$. The X-ray powder pattern, which closely resembles that of zussmanite, has strongest lines (diffractometer, Cu$K\alpha$) of 9.68(100,003), 4.835(30,006), 3.241(25,009,207), 2.793(70,306,312), 2.556(90,315,401), and 2.241 Å (50,410,324). By analogy to zussmanite, $a = 11.828(2)$, $c = 29.146(9)$.

The mineral occurs in a lenticular body of Mn-rich siliceous rock, about 0.5 × 1 m, in metagraywacke-argillite transitional from pumpellyite-actinolite to the pumpellyite-prehnite facies at Watsons Beach, southeastern Otago, New Zealand. The lens consists mainly of rhodonite and quartz, with subordinate amounts of rhodochrosite and traces of kutnohorite, manganoan calcite, spessartine, apatite, parsettensite, caryopilite, and coombsite. The new name is for D. S. Coombs of the University of Otago. Type material is in the Museum of the Geology Department at the University of Otago and in the Smithsonian Institution, Washington, DC. **J.L.J.**

Damaraite*

A.J. Criddle, P. Keller, C.J. Stanley, J. Innes (1990) Damaraite, a new lead oxychloride mineral from the Kombat mine, Namibia (South West Africa). Mineral. Mag., 54, 593–598.

The average of four electron microprobe analyses gave Pb 87.04, Cl 7.29, O 5.08 (calc.), sum 99.41 wt%, corresponding to $Pb_{4.02}O_{3.03}Cl_{1.97}$ for O + Cl = 5, ideally $Pb_4O_3Cl_2$. Occurs as subhedral grains, <200 × 150 μm, in interstices in calcite. Colorless, white streak, adamantine luster, transparent, $H = 3$, $VHN_{50} = 148$ (145–154), irregular to subconchoidal fracture, good {010} cleavage, $D_{calc} = 7.84$ g/cm^3 with $Z = 3$. Optically, weakly bireflectant, barely discernible reflectance pleochroism from gray to slightly bluish gray, weakly anisotropic. Reflectance values are given in 20-nm steps; representative values for R_1 and R_2 in air and in oil, respectively, are 470 17.15, 18.9 5.11, 6.27; 546 15.9, 17.0, 4.48, 5.09; 589 15.55, 16.4, 4.28, 4.79; 650 15.25, 16.0, 4.15, 4.57; for illuminant C (air), Y% 15.9, 16.9; λ_d 475, 472; P_e% 5.3, 8.9. Single-crystal X-ray study indicated orthorhombic symmetry, space group $Pma2$, $Pmam$, or $P2_1am$, $a = 15.104(1)$, $b = 6.891(1)$, $c = 5.806(1)$ Å as refined from a 114.6-mm Debye-Scherrer pattern (Fe radiation) with strongest lines of 3.164(60,401), 3.135(60,220), 2.902(100,121,002), 2.766(100,510,221), and 1.747-(60,313,721,531).

The mineral occurs in ptygmatic-like veins of barite-calcite-jacobsite-hematite, in which it is also associated with hausmannite, hematophanite, native copper, and a lead molybdenum oxychloride. The assemblage occurs in a manganese ore lens at the Kombat mine, 49 km south of Tsumeb, Namibia. The new name relates to the Damara sequence, the dolostones of which host the deposit. Type specimens are in the British Museum (Natural History), and in the Institut für Mineralogie und Kristallchemie, Universität Stuttgart. **J.L.J.**

Geminite*

H. Sarp, P. Perroud (1990) Geminite, $Cu_2As_2O_7 \cdot 3H_2O$, a new mineral from the Cap Garonne mine, Var, France. Schweiz. Mineral. Petrogr. Mitt., 70, 309–314 (in French, English abstract).

Chemical and TG analysis gave CuO 36.5, As_2O_5 52.4, H_2O 11.0, sum 99.9 wt%, corresponding to $Cu_{2.08}$-$As_{2.06}O_{7.24} \cdot 2.76H_2O$, ideally $Cu_2As_2O_7 \cdot 3H_2O$. Occurs abundantly as euhedral, intergrown crystals up to 0.3 × 0.06 mm on a specimen of quartz containing tennantite, covellite, chalcanthite, lavendulan, antlerite, and brochantite. Crystals are tabular {001}, slightly elongate [100], showing {001}, {100}, {010}, $\{hk0\}$, $\{h\bar{k}0\}$, $\{\bar{h}k0\}$, and $\{\bar{h}\bar{k}0\}$. Transparent, light green to sea green, vitreous luster, pale green streak, nonfluorescent, irregular fracture, perfect {001} cleavage, $H = 3$–3.5, soluble in dilute HCl; twinned polysynthetically parallel to {001}, $D_{meas} = 3.70(2)$, $D_{calc} = 3.71$ g/cm^3 with $Z = 4$. Optically biaxial positive, $\alpha = 1.656(2)$, $\beta = 1.692(2)$, $\gamma = 1.770(5)$ at 590 nm; $2V_{meas} = 75(5)°$, $2V_{calc} = 71°$, weak dispersion $r > v$, weakly pleochroic $\alpha = \beta$ = colorless, γ = pale green to pale gray; orientation α':(001) ≈ 90°, β':a = 17–18.5°, γ':b = 13°. Single-crystal X-ray study indicated triclinic symmetry $a = 6.639(3)$, $b = 8.110(3)$, $c = 15.739(9)$ Å, $\alpha = 92.01$, $\beta = 93.87$, $\gamma = 95.02(4)°$, as refined from the powder pattern (Guinier-Hägg, Cu radiation) with strongest lines of 7.83(100,002), 3.925(60,004), 3.850(30,021), 3.260(70,$0\bar{2}3$), 3.107(40,$12\bar{2}$), 3.070(70,201), 2.825-(40,$20\bar{3}$), and 2.611(50,$2\bar{2}0$,006). On heating, the mineral becomes anhydrous between 200 and 250 °C. The infrared spectrum is identical to that of the synthetic analogue.

The mineral occurs at the Cap Garonne mine, Var, France. The new name is derived from the Latin *gemini*, meaning twins, and alludes to the extensively twinned character of the mineral. The type specimen is in the Muséum d'Histoire naturelle de Genève, Geneva, Switzerland. **J.L.J.**

Gravegliaite*

R. Basso, G. Lucchetti, A. Palenzona (1991) Gravegliaite, $MnSO_3 \cdot 3H_2O$, a new mineral from Val Graveglia (northern Apennines, Italy). Z. Kristallogr., 197, 97–106.

Electron microprobe analyses (mean of 13) gave MnO 37.83, SO_2 33.51, H_2O (by difference) 28.66, sum 100 wt%, corresponding to $Mn_{1.01}S_{0.99}H_{6.02}O_{6.00}$, ideally $MnSO_3 \cdot 3H_2O$. The mineral occurs as colorless euhedral crystals up to 0.5 mm long, elongate [010] and prismatic $\{h0l\}$ with dipyramidal termination; also as sheaflike or radial aggregates up to 0.2 mm in diameter. White streak, vitreous luster, transparent, nonfluorescent, cleavable parallel to [010], insoluble in H_2O, soluble in strong acids, $D_{calc} = 2.39$ g/cm³ with $Z = 4$.Optically biaxial positive, $\alpha = 1.590(2)$, $\beta = 1.596(2)$, $\gamma = 1.636(2)$, $2V_{meas} = 41(3)°$, $2V_{calc} = 43°$, strong dispersion. Single-crystal X-ray structure study ($R = 0.036$) indicated orthorhombic symmetry, space group *Pnma*, $a = 9.763(1)$, $b = 5.635(1)$, $c = 9.558(1)$ Å, corresponding well with data for previously known synthetic $MnSO_3 \cdot 3H_2O$. Strongest lines of the powder pattern (Gandolfi camera, $FeK\alpha$) are 6.83(S,101)[$I_{calc} = 100$], 4.33(VS,201,111,102)[30,98,58], 3.43(VS,211,202,112)[42,13,49], 2.704(M,311)[51], 2.666(M,203,113)[29,5], 2.414(M,213)[51], and 1.726(M,231,512,422,132)[3,10,7,13].

The mineral occurs in cavities along fractures that cut hematite- and Mn-bearing (tephroite, bementite, braunite, hausmannite) layers of manganese ore at the Gambatesa mine, Val Graveglia, Eastern Liguria, Italy. The layers are radiolarian cherts in an ophiolitic sequence; the more siliceous layers along the same fractures containing the new sulfite locally have chalcocite and, rarely, alabandite. The new name is for the locality. Type material is in the Mineralogy Section of the Department of Earth Sciences, University of Genoa, Genoa, Italy. **J.L.J.**

Wattersite*

A.C. Roberts, M. Bonardi, R.C. Erd, A.J. Criddle, Y. Le Page (1991) Wattersite, $Hg_4^{+1}Hg^{+2}Cr^{+6}O_6$, a new mineral from the Clear Creek claim, San Benito County, California. Mineral. Record, 22, 269–272.

Electron microprobe analysis gave HgO 93.6, Cr_2O_3 8.7, sum 102.3 wt%. Partitioning of Hg^{1+} and Hg^{2+} in the ratio 4:1 on the basis of X-ray crystal structure analysis gave Hg_2O 72.1, HgO 18.7, CrO_3 8.7, sum 99.5 wt%, corresponding to $Hg^{1+}_{3.98}Hg^{2+}_{0.99}Cr^{6+}_{1.01}O_6$. Occurs as thin shell-like aggregates in vugs; less common as crystals, typically <0.1 mm, and as crystal aggregates on fractures; crystals elongate [001], showing large {110} and {010}, small to medium {310}, {130}, and {021}, and numerous smaller forms. Color dark reddish brown, black in masses, streak dark brick red, opaque but translucent on thin edges, submetallic luster, brittle, conchoidal fracture, nonfluorescent, twinning ubiquitous on {100}, $H = <5$, $D_{calc} = 8.91$ g/cm³ with $Z = 4$. In reflected light, slightly greenish white to lilac gray, moderately bireflectant and pleochroic, bright red internal reflection, strongly anisotropic. Reflectance values for two grains are given in 10-nm steps from 400 to 700 nm in air and in oil. Single-crystal X-ray structural study showed monoclinic symmetry, space group *C*2/*c*, $a = 11.250(5)$, $b = 11.630(7)$, $c = 6.595(5)$ Å, $\beta = 98.16(4)°$, as refined from a 114.6-mm Debye-Scherrer powder pattern (Co radiation) with strongest lines of 8.06(80,110), 5.58(50,200), 3.60(50,$\bar{2}$21), 3.300(60,$\bar{3}$11), 3.260(60,002), 2.948(50,311), 2.920(50,112,040), and 2.655(100,202,041).

The mineral occurs with quartz, opal, magnesite, cinnabar, mercury, and numerous other minerals, including several rare mercury-bearing species, in a small prospect pit near the abandoned Clear Creek mercury mine, New Idria District, San Benito County, California. The new name is for Lu Watters (1911–1989), mineral collector. Type material is in the National Mineral Collection housed at the Geological Survey of Canada, Ottawa. **J.L.J.**

Fe chloride

E.H. Dahlberg, B. Saini-Eidukat (1991) A chlorine-bearing phase in drill core of serpentinized troctolitic rocks of the Duluth Complex, Minnesota. Can. Mineral., 29, 239–244.

After several months of exposure to air, numerous drill cores from the Duluth Complex show a rusty brown, Cl-bearing iron oxide alteration. The alteration originates from brown, veinlike intergrowths up to 200 μm long and 20 μm across, near or in partly serpentinized olivine grains. Electron microprobe analyses gave Fe 46.03–48.66, Cl 12.99–14.17, OH (by difference) 37.17–40.81, sum 100 wt%, corresponding to $Fe^{2+}Cl_{0.43-0.46}(OH)_{2.51-2.91}$, possibly $Fe_2^{2+}(OH)_5Cl$. The origin of the mineral is attributed to invasion by Cl-bearing solutions during or after serpentinization. **J.L.J.**

Unnamed borate, unnamed gadolinite-type mineral

G. Della Ventura, G.C. Parodi, A. Mottana (1990) New rare earth minerals in the sanidine ejecta within pyroclastic rocks of the Roman potassic province. Rendiconti Fisiche Accad. Lincei, Ser. 9, 1, 159–163.

Unnamed borate

Electron and ion microprobe analyses gave CaO 1.34, Al_2O_3 29.40, La_2O_3 14.53, Ce_2O_3 18.63, Pr_2O_3 4.37, Nd_2O_3 2.11, Dy_2O_3 0.06, ThO_2 1.68, B_2O_3 29.56, OH (calc. for O,OH = 9) 0.08, sum 101.76 wt%. OH was shown to be present, but carbonate, nitrate, and sulfate absent, by Raman microprobe. The empirical formula is $(Ce_{0.402}La_{0.316}Pr_{0.094}Nd_{0.045}Dy_{0.001}Th_{0.023}Ca_{0.085})_{\Sigma 0.966}Al_{2.040}B_{3.005}(O_{8.969}OH_{0.031})$, simplified as $(Ce,La)Al_2B_3O_9$. Occurs as light yellow, translucent, platy crystals to 2 mm, hexagonal in outline and with a tapered, flat termination. Perfect basal and distinct prismatic cleavages, white streak.

Optically uniaxial positive, $\omega = 1.703(2)$, $\epsilon = 1.711(5)$. The X-ray pattern (not given) was indexed on a hexagonal cell, $a = 4.610(1)$, $c = 9.358(8)$ Å. The mineral occurs in a sanidine-lined vug in syenitic ejectum from the Sabatini volcanic complex, Sacrofano caldera, Latium, Italy.

Gadolinite-type mineral

The mineral occurs as multiply twinned blue crystals, mainly 0.1–0.3 mm long, that form rounded short prismatic aggregates. Electron and ion microprobe analyses gave BeO 2.75, CaO 12.25, B_2O_3 8.76, Fe_2O_3 7.76, Y_2O_3 7.81, La_2O_3 1.41, Ce_2O_3 7.89, Pr_2O_3 1.36, Nd_2O_3 7.53, Sm_2O_3 1.60, Dy_2O_3 0.72, SiO_2 27.12, ThO_2 5.80, H_2O (calc.) 7.24, sum 100 wt%, corresponding to $Ca_{0.877}$(Y,REE)$_{0.772}Fe^{3+}_{0.391}B_{1.012}Be_{0.442}Si_{1.814}Th_{0.088}(OH)_{3.23}O_{6.77}$. Cell dimensions calculated from a Gandolfi powder pattern are monoclinic, $a = 9.85$, $b = 7.68$, $c = 4.77$ Å, $\beta = 90.6°$. The pattern is similar to that of minerals in the gadolinite group. The mineral occurs in a specimen of sanidinic ejecta near the shore of Lake Vico, Latium Italy. **J.L.J.**

OH-bearing cancrinite

T.N. Nadezhina, R.K. Rastsvetaeva, E.A. Pobedimskaya, A.P. Khomyakov (1991) Crystal structure of natural hydroxyl-containing cancrinite. Kristallografiya, 36, 591–595 (in Russian; English translation in Soviet Phys. Crystallogr., 36(3), 325–327).

The mineral occurs in ultra-agpaitic pegmatites and hydrothermalites in the Lovozero alkaline massif, Kola Peninsula, USSR. Chemical analysis is reported to have given the empirical formula $(Na_{7.46}Ca_{0.16}K_{0.10}Mg_{0.03}Fe_{0.02})_{\Sigma 7.77}(Al_{6.03}Si_{5.97})_{\Sigma 12.00}O_{24}(OH)_{1.23}(CO_3)_{0.36} \cdot 2.3H_2O$. The infrared spectrum shows weakened absorption bands at 1375 and 1460 cm^{-1} in accordance with the relatively low carbonate content, whereas bands at 1620, 3513, and 3580 cm^{-1}, which are assignable to OH and H_2O, are stable or slightly increased in intensity relative to carbonate-rich cancrinite. Optically positive. Single-crystal X-ray study ($R = 0.03$) indicated hexagonal symmetry, $a = 12.74(3)$, $c = 5.182(2)$ Å; space group of the tetrahedral framework and the fairly stable extraframework atoms is $P6_3$, and that of the "mobile" extraframework OH, CO_3^{2-}, and H_2O is $P3$. The structurally derived formula corresponds to $Na_8Al_6Si_6O_{24}(OH)_{1.4}(CO_3)_{0.3} \cdot 6H_2O$. **J.L.J.**

Ganophyllite-type mineral

A. Mottana, G. Della Ventura, G.C. Parodi, G. Guidi (1990) A calcian member of the ganophyllite group in the manganiferous metacherts of Molinello mine, Liguria, Italy. Rendiconti Fisiche Accad. Lincei, Ser. 9, 1, 313–317.

Electron microprobe analyses showed two distinct populations, one with Ca > Na > K, and the other with Ca > (Na + K); results for the latter are CaO 1.89, Na_2O 0.61, K_2O 0.15, MnO 34.82, CuO 1.09, SiO_2 45.14, Al_2O_3 4.55 wt%, corresponding to $(Ca_{1.53}Na_{0.94}K_{0.15})_{\Sigma 2.62}(Mn_{23.35}Cu_{0.65})_{\Sigma 24.00}(Si_{33.75}Al_{4.25})_{\Sigma 40.00}$. Occurs as greenish white flakes in fan-shaped clusters 5–7 mm in diameter. White streak, vitreous luster, translucent, brittle, perfect pinacoidal cleavage, and a parting at 60° angles. Optically biaxial, $\beta = 1.605$, $\gamma = 1.607$, $2V = 20–24°$. The X-ray powder pattern (not given) has 14 peaks, of which the only three appreciably above background are at 12.52(100), 3.14(20), and 4.18(10) Å. X-ray single-crystal study gave orthorhombic symmetry, space group *Pnam* or Pna_1 [sic], $a = 16.782$, $b = 13.370$, $c = 25.090$. The mineral occurs with parsettensite and nambulite in a fragment of chert from the abandoned Molinella manganese mine near Chiavari, Liguria, Italy. **J.L.J.**

Na-K-Fe silicate

R.K. Rastsvetaeva, O.Yu. Rekhlova, A.P. Khomyakov (1991) Crystal structure of a new natural Na,K,Fe-silicate. Kristallografiya, 36(4), 892–897 (in Russian).

Electron microprobe analysis (not given) corresponds to $Na_4K_3(Fe^{2+}_{0.9}Mn_{0.7}Ti_{0.4}Mg_{0.1})_{\Sigma 2.1}Si_8O_{22} \cdot nH_2O$ where $n = \sim 7$. Elongate along c, cleavages {100} and {010}, $H = 2–3$, $D_{meas} = 2.75$, $D_{calc} = 2.69$ g/cm^3 with $Z = 1$. Optically biaxial positive, $\alpha = 1.569$, $\beta = 1.574$, $\gamma = 1.590$, $2V = 58°$. X-ray structural study ($R = 0.04$) gave triclinic symmetry, space group $P\overline{1}$, $a = 10.244(2)$, $b = 11.924(3)$, $c = 5.276(3)$ Å, $\alpha = 103.491(2)$, $\beta = 96.960(3)$, $\gamma = 91.945(3)°$. The structural formula is $[Na_4K_3(H_2O)_4]\{[M_2(OH)_2][Si_8O_{20}(OH)_2]\}$ where M = Fe^{2+}, Mn, Ti, Mg. The mineral occurs in the Lovozero alkaline massif, Kola Peninsula, USSR. **J.L.J.**

New Data

δ-Al_2O_3

H. Saalfeld, W. Guse (1991) The mysterious "δ-Al_2O_3." Neues Jahrb. Mineral. Abh., 163, 159–167.

A new cubic alumina phase (σ-Al_2O_3) with a spinel-type structure was synthesized and described by Guse and Saalfeld in 1990 (*Neues Jahrb. Mineral. Mon.*, 217–226). The basic structure consists of a cubic closest packing of O, with the cations in tetrahedral and octahedral sites. X-ray and electron diffraction studies of newly synthesized material indicate that in σ-Al_2O_3 the cations completely occupy the tetrahedral sites and fill the octahedral positions to 83%. Deformation of the closest-packed O array leads to X-ray satellites (tetragonal symmetry) surrounding the spinel reflections; in particular conditions the spinel-type reflections disappear, and those of the satellites have been found to match well the published d values for δ-Al_2O_3. It is concluded that δ-Al_2O_3 is not an independent phase with a distinct symmetry and crystal structure but is probably only a special disordered domain structure of σ-Al_2O_3.

Discussion. The report of a natural occurrence of δ-Al_2O_3

was abstracted in *Am. Mineral.* 77, p. 210 (1992); the new data indicate that the δ phase now becomes the σ phase. **J.L.J.**

Ardennite

M. Pasero, T. Reinecke (1991) Crystal chemistry, HRTEM analysis and polytypic behaviour of ardennite. Eur. Jour. Mineral., 3, 819–830.

The ideal formula of ardennite is $(Mn,Ca,Mg)_4$-$[(Al,Fe^{3+})_5Mg](AsO_4)(SiO_4)_2(Si_3O_{10})(OH)_6$. HRTEM and electron microprobe examination of ardennite specimens from Haute-Maurienne, French Alps, showed no anomalies, whereas those from Evvia (Euböa) Island, Greece, showed that 65–93% of the (AsO_4) tetrahedron is occupied by Si. The Evvia mineral shows an intergrowth of the standard 18.5-Å structure (*c* dimension) with abundant lamellae of a 37-Å polytype. **J.L.J.**

Chestermanite

V. Alfredsson, J.-O. Bovin, R. Norrestam, O. Teresaki (1991) The structure of the mineral chestermanite, $Mg_{2.25}Al_{0.06}Fe_{0.43}Ti_{0.02}Sb_{0.13}O_2BO_3$. A combined single-crystal X-ray and HREM study. Acta Chem. Scand., 45, 797–804.

X-ray structural study ($R = 0.043$) based on nondiffuse reflections gave orthorhombic symmetry, space group *Pbam*, $a = 18.525(4)$, $b = 12.272(2)$, $c = 3.0218(4)$ Å, structurally isotypic with orthopinakiolite. The composition in the title is that by energy-dispersive analysis; the composition obtained by X-ray study is $(Mg,Al)_{2.494}$-$(Fe,Ti)_{0.386}Sb_{0.120}O_2BO_3$. The main source for the diffuse superlattice reflections, which led to the previous doubling of the *c* parameter, is interpreted to be ordering between Sb and (Mg,Al) at the M1 position, within domains of the structure. **J.L.J.**

Dinite

L. Franzini, M. Pasero, N. Perchiazzi (1991) Re-discovery and re-definition of dinite, $C_{20}H_{36}$, a forgotten organic mineral from Garfagnana, northern Tuscany, Italy. Eur. Jour. Mineral., 3, 855–861.

Dinite, a name which has lapsed into obscurity, was originally described in 1852 as an organic mineral from a thin lignite deposit in the Garfagnana Valley, northern Tuscany, Italy. The original sample was rediscovered in the collections of the Museum of Natural History at the University of Pisa; a new chemical analysis gave C 86.77, H 13.44, sum 100.21 wt%, corresponding to $C_{20}H_{36.91}$, ideally $C_{20}H_{36}$. The new analysis is in good agreement with the original (1852) results, although the latter was incorrectly calculated as $C_{18}H_{16}$. Transparent, "icy" appearance, massive, crystalline, $D_{meas} = 1.01(1)$, $D_{calc} = 1.02$ g/cm³, fuses at 33–34 °C, soluble in $CHCl_3$, CH_2Cl_2, CCl_4, and $C_6H_5(CH_3)$. The infrared spectrum shows features typical of a saturated hydrocarbon. X-ray structure study ($R = 0.068$) of a crystal obtained by slow evaporation of a solution of dinite in ethanol gave orthorhombic symmetry, space group $P2_12_12_1$, $a = 12.356(4)$, $b = 12.762(4)$, $c = 11.427(3)$ Å. A Gandolfi pattern of natural material (Cu*Kα* radiation) gave strongest lines of 8.92(ms,110), 8.32(ms,101), 7.00(s,111), 5.53(vs,021), 5.06(vs,121), and 4.02(ms,122,130); a Gandolfi pattern of the artificially recrystallized material gave the same result.

The mineral was originally named for Professor Dini, who found the mineral. The type specimen is in the Museo di Storia Naturale e del Territorio, University of Pisa, Pisa, Italy. **J.L.J.**

Kuznetsovite

L.P. Solovyeva, S.V. Tsybulya, V.A. Zabolotnyi, N.A. Pal'chik (1991) Determination and refinement of the structure of kuznetsovite, from powder-diffraction data. Kristallografiya, 36(5), 1292–1294 (in Russian).

Refinement of the structure from 51 powder diffraction lines (diffractometer, Cu radiation) gave $a = 8.4013(2)$ Å, space group $Pm3m$, $P432$, $P\bar{4}3m$, $P4_232$, $P23$, or $P2_13$. The original formula was $Hg_6As_2Cl_2O_9$; the new structurally derived formula is $Hg_3Cl[AsO_4]$. **J.L.J.**

Rinkite

R.K. Rastsvetaeva, B.E. Borutskii, A.V. Shlyukova (1991) Crystal structure of Hibbing rinkite. Kristallografiya, 36(3), 632–636 (in Russian, English translation in Soviet Phys. Crystallogr., 36(3), 349–351).

X-ray structure study ($R = 5.02\%$) of single-crystal rinkite from the Hibbing feldspar-aegirine pegmatite, Khibiny massif, USSR, gave monoclinic symmetry, space group $P2_1$, $a = 5.679(3)$, $b = 7.412(3)$, $c = 18.835(6)$ Å, $\alpha = 101.26(3)°$, $D_{meas} = 3.29(3)$, $D_{calc} = 3.36$ g/cm³ with $Z = 2$. An electron microprobe analysis (not given) corresponds to $(Ca_{3.7}Na_{2.4}REE_{0.8}Sr_{0.15})_{\Sigma 7.05}(Ti_{0.92}Nb_{0.06}$-$Zr_{0.03})_{\Sigma 1.01}(Si_{3.85}O_{14})O_{1.3}F_{2.55}$ where REE = $Ce_{0.315}Nd_{0.19}$-$La_{0.10}Y_{0.09}Pr_{0.05}Sm_{0.05}$. The structural formula is $(Ca,REE)_4\{Na(Na,Ca)_2F(O,F)\}\{TiF(O,F)[Si_2O_7]_2\}$. Ca does not occupy an independent position, resulting in a lowering of symmetry from the space group $P2_1/c$ that has been reported previously for rinkite.

Discussion. See the discussion for nacareniobsite-(Ce) in *Am. Mineral.*, 76, p. 708 (1990). The general formula for Hibbing rinkite is analogous to that given for nacareniobsite, but differs substantially from that of rinkite in Fleischer's *Glossary of Mineral Species* (1991). **J.L.J.**

Strätlingite, vertumnite

R. Rinaldi, M. Sacerdoti, E. Passaglia (1990) Strätlingite: Crystal structure, chemistry, and a reexamination of its polytype vertumnite. Eur. J. Mineral., 2, 841–849.

A new electron microprobe analysis of holotype strätlingite from Bellerberg, Germany, gave SiO_2 17.55, Al_2O_3 23.22, CaO 25.13, SrO 1.09, BaO 0.90, Na_2O 0.13, K_2O 0.18, H_2O (by difference) 31.80, sum 100 wt%, corresponding to the structurally derived formula $(Ca_{1.90}Sr_{0.04}Ba_{0.03}Na_{0.02}K_{0.01})_{\Sigma 2.00}Al(Al_{0.93}Si_{1.24})_{\Sigma 2.17}O_{2.13}(OH)_{10.44}\cdot 2.25H_2O$, ideally $Ca_2Al(Al,Si)O_2(OH)_{10}\cdot 2.25H_2O$, in good agreement with data for strätlingite from Mantalto di Castro, Italy. Single-crystal X-ray structural study (isotropic R = 0.080) of the latter gave rhombohedral symmetry, space group $R\overline{3}m$, a = 5.753(6), c = 37.82(5) Å as refined from a 114.6-mm Gandolfi powder pattern (Cu radiation) with strongest lines 12.69(vs,003), 6.28(m,broad, 006), 4.200(vs,broad,009), 2.874(s,110), 2.488(m,021), 2.366(m,205), and 1.848(s,broad,214).

Electron microprobe analysis of holotype vertumnite gave SiO_2 18.1, Al_2O_3 25.26, CaO 25.88, SrO 0.81, BaO 0.18, Na_2O 0.07, K_2O 0.02, H_2O^+ 23.74 and H_2O^- 5.96 (TGA), sum 99.93 wt%, corresponding to the structurally derived formula $(Ca_{1.95}Sr_{0.03}Ba_{0.01}Na_{0.01})_{\Sigma 2.00}Al(Al_{1.09}Si_{1.27})_{\Sigma 1.36}O_{3.16}(OH)_{9.03}\cdot 2.45H_2O$, ideally $Ca_2Al(Al,Si_{1.25})O_3(OH)_9\cdot 2.45H_2O$.

The c parameter of vertumnite is about two-thirds that of strätlingite, and strätlingite has a larger proportion of vacant tetrahedral sites and a higher degree of hydration. The minerals can be classified as mixed module polytypes with constant module proportions (type II polytypes). **J.L.J.**

Testibiopalladite

Won-Sa Kim, G.Y. Chao (1991) Phase relations in the system Pd-Sb-Te. Can. Mineral., 29, 401–409.

Synthesis in the system Pd-Sb-Te indicated that testibiopalladite, ideally PdSbTe, is a member of the $PdSb_2$-$PdTe(Sb_{0.64}Te_{0.36})$ solid solution rather than an ordered 1:1:1 compound. The formula thus becomes PdTe(Sb,Te), probably with minor Bi in the (Sb,Te) position. **J.L.J.**

Vesignieite

Zhesheng Ma, Ruilin He, Xiaoling Zhu (1990) Redetermination of the crystal structure of vesignieite. Acta Gelogica Sinica, 64(4), 302–308 (in Chinese, English abstract).

Single-crystal X-ray structural study (R = 0.051) of vesignieite, $Cu_3Ba(VO_4)_2(OH)_2$, gave monoclinic symmetry, space group $C2/m$, a = 10.270(2), b = 5.911(1), c = 7.711(2) Å, β = 116.42(3)°, Z = 2. Strongest lines of the X-ray powder pattern are 3.220(100,112), 2.953(40,311), 2.7135(80,312), 2.5635(60,$\overline{1}$12), 2.2960(60,222), 1.6136(40,224), and 1.4790(40,040). The cell dimensions and space group are new. **J.L.J.**