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NEW MINERAL NAMES*

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Girvasite*

S.N. Britvin, Ya.A. Pakhomovskiy, A.N. Bogdanova, Ye.V. Sokolova (1990) Girvasite—A new carbonate-phosphate of sodium, calcium and magnesium from carbonatites of the Kovdor massif (Kola Peninsula). Mineral. Zhurnal, 12(3), 79–83 (in Russian).

Electron-microprobe analyses (H_2O by coulometry and TGA; CO_2 by difference between total weight loss and H_2O) gave Na_2O 5.0, 5.0, CaO 16.7, 13.9, SrO –, 3.5, MgO 18.5, 17.2, MnO 0.1, 0.3, FeO 1.2, 1.5, P_2O_5 32.6, 32.5, CO_2 7.4, –, H_2O 18.0, –, sum 99.5, – wt%. The first analysis corresponds to $Na_{1.05}Ca_{1.95}(Mg_{3.00}Mn_{0.01}Fe^{2+}_{0.11})_{\Sigma 3.12}(CO_3)_{1.10}(PO_4)_3\cdot 6.53H_2O$; the ideal formula from crystal-structure study is $NaCa_2Mg_3(PO_4)_2[PO_2(OH)_2](CO_3)(OH)_2\cdot 4H_2O$. No other constituents were detected. There is a strong endothermic peak at 370 °C and a weak one at 580 °C, the first corresponding to loss of H_2O, which is also lost at 700–750 °C. CO_2 is gradually lost between 400 and 1000 °C. Absorption features in the infrared spectrum are at 3450, 3200, 1640, 1520, 1435, 1110, 1090, 1035, 980, 880, 750, 715, 635, 615, 600, 575, and 560 cm^{-1}. The sharp feature at 3450 cm^{-1} is evidence for OH, the feature at 1640 cm^{-1} for molecular H_2O, whereas the features at lower wave numbers are assigned to CO_3 and PO_4 groups. Readily soluble in cold 10% HCl. The mineral forms spherulites to 1.5 mm in diameter, rarely single prismatic crystals elongate [100] and up to 1 mm long and 0.07 mm across. Color of spherulites creamy white; single crystals colorless and transparent; white streak, luster silky for aggregates, vitreous for single crystals; nonfluorescent, $H = 3.5$, very brittle, cleavage {001} perfect, $D_{meas} = 2.46(2)$ in heavy liquids, $D_{calc} = 2.529(5)$ g/cm³ for $Z = 4$. Optically biaxial negative, $\alpha = 1.541(2)$, $\beta = 1.557(2)$, $\gamma = 1.565(2)$ for $\lambda = 589$ nm, $2V_{meas} = 60(5)°$, $2V_{calc} = 71°$, $Y = b$, $a \wedge Z = 31°$. Single-crystal X-ray study gave monoclinic symmetry, space group $P2_1/c$; $a = 6.507(6)$, $b = 12.267(5)$, $c = 21.403(8)$ Å, $\beta = 90.37(6)°$ from powder data (Cu$K\alpha$ radiation, diffractometer). Strongest lines in the pattern (57 given) are 10.72(100,002), 3.57(80,006), 3.42(26,016, 115), 3.08(32,026,125), 2.817(26,043), 2.108(32), and 2.016(35).

The mineral occurs in solution cavities in dolomite carbonatite at Kovdor, Kola Peninsula, USSR, where it is intimately intergrown with bobierrite; minor pyrite is also present, and dolomite lines the cavities. It is a low-temperature, hydrothermal mineral formed from phosphatic solutions at 100–250 °C. The name is for Lake Girvas. Samples have been deposited in the Fersman Mineralogical Museum, Moscow, and in the Mining Museum of the Leningrad Mining Institute.

Discussion. The mineral differs in chemical composition and crystal structure from other phosphate-carbonates: heneuite, bradleyite, sidorenkite, and bonshtedtite. Its crystal structure, briefly discussed in the present paper, is reported in more detail in *Doklady Akad. Nauk SSSR*, 311, 1372–1376, 1990 (in Russian). **E.S.G.**

Komkovite*

A.V. Voloshin, Ya.A. Pakhomovskiy, Yu.P. Men'shikov, Ye.V. Sokolova, Yu.K. Yegorov-Tismenko (1990) Komkovite—A new hydrous barium zirconosilicate from the carbonatites of Vuoriyarvi (Kola Peninsula). Mineral. Zhurnal, 12(3), 69–73 (in Russian).

Electron-microprobe analyses of four crystals gave BaO 28.23, 29.97, 27.49, 28.19, CaO 0, 0, 0.04, 0.08, MnO 0.16, 0.21, 0, 0, FeO 0.18, 0.10, 0.31, 0.33, K_2O 0.04, 0.06, 0.26, 0.13, ZrO_2 24.45, 26.40, 23.41, 24.94, HfO_2 –, –, 0.31, 0.46, SiO_2 32.90, 34.65, 34.24, 34.44, sum 85.96, 91.39, 86.06, 88.57 wt%. Coulometric analyses gave H_2O 10 to 11.5 wt% (average 10.7). The formula corresponding to the fourth analysis (plus H_2O analysis) is $(Ba_{0.95}Fe_{0.02}Ca_{0.01}K_{0.01})_{\Sigma 0.99}(Zr_{1.04}Hf_{0.01})_{\Sigma 1.05}Si_{2.95}O_9\cdot 3.08H_2O$, ideally $BaZrSi_3O_9\cdot 3H_2O$. No other constituents were detected. There is one endothermic peak at 140 °C corresponding to the maximum loss of H_2O, which is lost completely at 600 °C. Absorption features in the infrared spectrum are at 3540, 3510, 1665, 1650, 1045, 970, 920, 740, 545, and 495 cm^{-1}, the first four corresponding to molecular H_2O. The mineral forms equant crystals, 1–5 mm across, with trigonal pyramidal faces; color brown, streak light brown, vitreous luster, nonfluorescent, light blue cathodoluminescence, $H = 3–4$, brittle, no cleavage, $D_{meas} = 3.31(5)$ in heavy liquids, $D_{calc} = 3.38(1)$ g/cm³ with $Z = 6$. Optically uniaxial negative, brown, nonpleochroic, $\omega = 1.671(1)$, $\epsilon = 1.644(1)$ for $\lambda = 589$ nm. Single-crystal X-ray study indicated hexagonal symmetry, space group $P3$, $a = 10.526(6)$, $c = 15.736(9)$ Å. Strongest lines in the powder pattern (67 given) are 5.23(100,110,003), 3.59(80,104),

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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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3.02(80,300), 2.96(90,024,105), 2.571(60,214,025), and 2.106(60,230).

The mineral was found in dolomitic veinlets that cut metasomatically altered pyroxenites in the Vuoriyarvi carbonatite complex, Kola Peninsula, USSR. The mineral occurs in a drill core at 80–90 m depth, associated with dolomite, strontianite, phlogopite, barite, georgechaoite, and pyrite, and apparently formed by alteration of catapleiite. The new name honors Soviet mineralogist and crystallographer A.I. Komkov (1926–1987). The type specimen is in the Fersman Mineralogical Museum, Moscow. **E.S.G.**

Kurilite

V.A. Kovalenker, I.Ya. Nekrasov, S.M. Sandomirskaya, A.N. Nekrasova, V.S. Malov, V.Ya. Danchenko, M.T. Dmitriyeva (1989) Sulfide-selenide-telluride mineralization of epithermal manifestations of Kurile-Kamchatka volcanic belt. Mineral. Zhurnal, 11(6), 3–18 (in Russian).

Electron-microprobe analyses (two given here, together with ranges of all 12 reported) gave Ag 65.07, 61.72 (61.72–68.11), Au 1.17, 0.65 (0.10–3.58), Te 24.64, 34.77 (23.54–34.77), Se 9.14, 2.17 (1.43–9.14), S 0.10, 0.19 (0.10–3.93, seven analyses), sum 100.12, 99.50 (97.11–101.55) wt%, corresponding to $Ag_{1.96}Au_{0.02}Te_{0.63}Se_{0.38}S_{0.01}$ and $Ag_{1.95}Au_{0.01}Te_{0.92}Se_{0.09}S_{0.02}$ (normalized to total atoms = 3), which simplify to $(Au,Ag)_2(Te,Se,S)$. Occurs as anhedral grains, metallic luster, cleavage not observed, opaque. In reflected light, white, similar to galena. Isotropic, internal reflections absent. Reflectance at λ = 580 nm is 38.1% (WTiC standard): plot of variation of reflectance with λ shows a monotonic decrease from 39% at 420 nm to 37% at 700 nm. X-ray powder study shows the mineral to be isotropic, space group *Pm*3*n* or *P*43*n*, *a* = 11.27(1) Å. The strongest lines (14 given) are 3.00(90,123), 2.52(50,240), and 2.427(50,332) (no line is given with 100 intensity).

The mineral is associated with Au-Ag tellurides in the Prasolov occurrence, where it forms isolated, xenomorphic segregations in quartz; locally replaces tetrahedrite-tennantite or is intergrown with hessite and petzite such that hessite is overgrown by the mineral, whereas petzite forms tiny oval grains in it. The mineral is inferred to have formed as the activities of Se and Te increased at roughly 150–200 °C during a relatively late stage of mineralization.

Discussion. The authors report that the mineral differs optically from hessite in being isotropic and in lacking the rose-brown tint characteristic of hessite, and from petzite in being white, like galena, not gray with a brown tint as for petzite. The reflection spectra for hessite, petzite, and the unnamed mineral are shown to be distinct from one another. A footnote in the paper indicates that the mineral was submitted to the IMA under the name kurilite. No submission has been made. **E.S.G.**

Moissanite-*6H*, -*33R*, -*15R*, β-SiC

I. Leung, W. Guo, I. Friedman, J. Gleason (1990) Natural occurrence of silicon carbide in a diamondiferous kimberlite from Fuxian. Nature, 346, 352–354.

V.K. Marshintsev (1990) Natural silicon carbide in kimberlitic rocks of Yakutiya. Mineral. Zhurnal, 12(3), 17–26 (in Russian).

Electron-microprobe analyses of the Yakutian α-SiC (moissanite) gave Si 66.612, 51.880, 65.20, Fe 0.038, 0.495, – wt%. Spectral analyses show insignificant amounts of Al, Mg, Ca, Ti, Mn, and Cr. Fuxian moissanite forms crystals to 5 mm in diameter, deep blue when larger, color-zoned when smaller. Platy crystals have the form $\{10\bar{1}0\}$ well developed and are elongate parallel to the *a* axis; crystals are commonly rounded, resorbed. Yakutian moissanite forms rounded to euhedral, pinacoidal crystals 0.5–1.2 mm across. Most crystals are blue-green; fewer are blue, green, or colorless; rare ones are yellow. Pleochroism is weak in the strongly colored varieties. Cleavage is weak parallel to basal pinacoid. Optically, $\epsilon > 2.7$. D_{meas} = 3.27–3.29 g/cm³. Single-crystal studies of the Fuxian mineral show that a dark crystal is the well-ordered *6H* polytype of α-SiC; Laue diagrams of the Yakutian material indicate that the *6H* and *33R* polytypes are present; the *15R* polytype is also reported. The X-ray powder pattern of the *6H* polytype has the strongest lines (23 given) 2.49(100), 2.33(60), 1.52(100), 1.31(100), and 1.13(60); that of the *33R* polytype has the strongest lines (23 given) 2.505(100), 2.388(50), 1.532(100), 1.435(40), and 1.314(100); that of the *15R* polytype has the strongest lines (16 given) 2.57(20), 2.504(90), 2.394(20), 1.538(100), 1.313(90), and 1.00 Å (30, broad).

The Fuxian moissanite occurs in a diamond-bearing kimberlite pipe emplaced in the Sino-Korean craton near Fuxian, Liaoning, China. The mineral is overgrown by vesicular β-SiC and forms epitaxial intergrowths with β-SiC; its crystal faces are coated by Si; quartz is also present. Moissanite is inferred to have formed with Si and diamond in the Earth's mantle at extremely low f_{O_2}. The Yakutian moissanite occurs in kimberlite from Yakutiya, USSR. It encloses Si and, less commonly, β-SiC and $FeSi_2$.

β-SiC

Electron-microprobe analyses of the Yakutian β-SiC gave Si 63.347, 61.568, 61.707, 64.20, Fe 0.045, 0.015, 0.015, – wt%. Fuxian β-SiC forms vesicular, milky masses on the order of 0.3 mm to 1.5 mm across that enclose moissanite, quartz, and transparent β-SiC euhedra; also occurs in epitaxial overgrowths on moissanite such that [110] of β-SiC is parallel to $[10\bar{1}0]$ of the moissanite. Yakutian β-SiC occurs as rare black rounded grains about 0.1 mm in diameter, intergrown or enclosed in moissanite. Single-crystal studies of Fuxian material show that the light-colored material intergrown with moissanite is the well-ordered *3C* polytype of β-SiC. The X-ray powder pattern of the Yakutian material has the lines 2.513(100), 2.181(10), 1.542(30), 1.313(30), 1.262(10), 1.091(10), 0.999(20), 0.992(20), and 0.987(10) Å.

The Fuxian mineral is inferred to have formed during rapid ascent and consequent vesiculation of CO_2-rich kimberlitic magma at *P-T* conditions where high quartz is also stable, viz., $P < 20$–28 kbar but >10 kbar and T near 1000 °C, and under more oxidizing conditions than earlier formed moissanite and diamond. The Yakutian material occurs in kimberlite from Yakutiya, USSR. In the case studied in detail, β-SiC occurs with SiO_2 in moissanite-*15R*.

Discussion. X-ray data for Yakutian moissanite-*15R* and chemical and X-ray data for Yakutian β-SiC were previously published by V.I. Marshinstev et al. (*Doklady Akad. Nauk,* 262, 204–206, 1982; English translation, *Doklady, Earth Science Sections,* 262, 163–166). Available information does not exclude the possibility that the SiC reported from Yakutia resulted from contamination by carborundum used in preparing the samples for study. The carbon isotopic composition is reported to be close to that in synthetic SiC. **E.S.G.**

Tuliokite*

V.N. Yakovenchuk, Ya.A. Pakhomovskiy, A.V. Voloshin, A.N. Bogdanova, N.A. Yamnova, D.Yu. Pushcharovskiy (1990) Tuliokite $Na_6BaTh(CO_3)_6 \cdot 6H_2O$—A new hydrous carbonate of sodium, barium and thorium from alkalic pegmatites of the Khibiny massif (Kola Peninsula). Mineral. Zhurnal, 12(3), 74–78 (in Russian).

Electron-microprobe analyses of three crystals (first two riddled with abundant inclusions of organic material) gave Na_2O 16.2, 16.9, 17.9, K_2O 0.1, 0, 0, CaO 0.1, 0, 0.1, SrO 0.2, 0, 0, BaO 14.6, 15.1, 14.6, Fe_2O_3 0.1, 0, 0.4, ThO_2 29.5, 26.5, 24.3. Measured Na_2O values are probably low because of volatization under the microprobe beam. Other elements with $Z > 11$ were not detected by microprobe, and Be, B, and Li were not detected by laser spectroscopy. The Penfield method and coulometry gave H_2O 14.0 wt%; H_2O is lost between 150 and 250 °C, which suggests molecular H_2O. CO_2, not analyzed because of the small amount of material available, was calculated to be 25.5 wt% from stoichiometry. The sum for the third crystal (which contains few inclusions) is 96.8% wt%, and the corresponding empirical formula normalized to eight cations is $Na_{5.99}(Ba_{0.99}Ca_{0.02})_{\Sigma 1.01}(Th_{0.95}Fe_{0.05})_{\Sigma 1.00}(CO_3)_{6.01} \cdot 8.06H_2O$. Crystal-structure analysis indicated an ideal formula $Na_6BaTh(CO_3)_6 \cdot 6H_2O$. Absorption features in the infrared spectrum at 1500, 1415, 880, 715, and 695 cm^{-1} are attributed to CO_3 groups; those at 3200 and 3505 cm^{-1} to molecular H_2O; other features are at 1790, 1150, 1070, 1025, and 445 cm^{-1}. Easily soluble in 10% HCl with evolution of CO_2. Forms prismatic crystals up to 4 mm and rhombohedral crystals; color light or dark gray, depending on the abundance of finely dispersed included organic material; vitreous luster, nonfluorescent, $H = 3$–4, no cleavage, brittle, $D = 3.15(2)$ in heavy liquids, $D_{calc} = 3.25(1)$ g/cm³ from the empirical formula, and $Z = 3$. In immersion oil, colorless, nonpleochroic, uniaxial positive, $\omega = 1.574(2)$, $\epsilon = 1.587(2)$ for $\lambda = 589$ nm. Crystal-structure refinement indicates hexagonal symmetry, space group $R\bar{3}$, $a = 14.175(7)$, $c = 8.605(4)$ Å from powder data (Cu$K\alpha$ radiation, diffractometer). Strongest lines of the pattern (64 given) are 7.03(85,101), 4.07(60,211), 3.51 (50,202), 3.15(80,122), 2.674(90,140,321), 2.354(100,051, 232), 2.039(60,422), and 1.959(65,152).

The mineral occurs in two parageneses in the nepheline syenites of Mount Kukisvumchorr in the Khibiny massive, Kola Peninsula, USSR. One is a pegmatite vein, 2–10 cm thick, of nepheline, cancrinite, aegirine, and microcline. The mineral as prismatic crystals is one of the latest to form in the concluding stage of a hydrothermal process, and it overgrew sidorenkite, vinogradovite, and villiaumite in cavities between altered microcline crystals. In the second paragenesis, the mineral occurs in natrolite-aegirine-microcline veinlets, 5–7 cm thick, as rhombohedral crystals on pirssonite and shortite; trona, thermonatrite, natron, and villiaumite fill interstices. The name is from the Tuliok River. Type material is in the Fersman Mineralogical Museum, Moscow, and in the Mining Museum of the Leningrad Mining Institute.

Discussion. Discrepancies between measured and calculated densities and between the water contents given in the empirical and crystallographic formulas, together with low analytical totals, suggest errors in the measured H_2O contents of the mineral. The structure was reported separately and was abstracted in *Am. Mineral.,* 76, p. 668, 1991. **E.S.G.**

$Bi_3(Se_2TeS)_{\Sigma 4}$

A.V. Yefimov, S.N. Nenasheva, Y.S. Borodayev, N.N. Mozgova, A.V. Sivtsov (1988) Hypogene selenium mineralization in the Neva tin ore deposit. Novye Dannye Mineral., 35, 128–151 (in Russian).

Electron-microprobe analyses gave Ag 0.12, –, Pb 5.27, 2.54, Bi 59.84, 64.48, Sb 0.22, –, Te 15.30, 12.68, S 3.27, 2.74, Se 15.39, 16.87, sum 99.42, 99.31 wt%, which correspond to $(Pb_{0.96}Ag_{0.04})_{\Sigma 1.00}(Bi_{10.96}Sb_{0.08})_{\Sigma 11.04}[(Se_{7.48}Te_{4.60})S_{3.92})]_{\Sigma 16.00}$ and $Pb_{0.96}Bi_{24.00}(Se_{16.64}Te_{7.76}S_{6.64})_{\Sigma 31.04}$, ideally $Bi_3(Se_2TeS)_{\Sigma 4}$. In reflected light, white with a weak yellow tint, brighter than wittite; weak bireflectance, no color effect with the anisotropy. The X-ray pattern (not given) is similar to that of laitakarite. Occurs as isolated segregations, up to 0.15 mm across, between lamellar grains of wittite. The Se mineralization, which also includes laitakarite, nevskite, bohdanowiczite, selenian bismuthinite, and selenian cosalite, accompanies a chloritic paragenetic association with arsenopyrite, chalcopyrite, sphalerite, galena, and tetrahedrite-tennantite at the Neva tin deposit, Magadan District, northeastern USSR. The cylindrical ore body is related to steep-dipping fractures near the tectonic contact between upper Cretaceous alaskitic granite and lower Cretaceous terrigenous sediments. The depth of ore deposition is estimated to have not exceeded 500–1000 m.

Discussion. The authors note that the mineral has a Te/Se ratio of 0.5, similar to that in skippenite, but differs from skippenite in the ratio of cations to anions and in that significant Pb and S are present. However, Pb content is variable, suggesting Pb ⇋ Bi substitution. **E.S.G.**

$(Ag,Cu)Bi_3(Se,S)_5$ and Te_3Se_4

V.A. Kovalenker, I.Ya. Nekrasov, S.M. Sandomirskaya, A.N. Nekrasova, V.S. Malov, V.Ya. Danchenko, M.T. Dmitriyeva (1989) Sulfide-selenide-telluride mineralization of epithermal manifestations of the Kurile-Kamchatka volcanic belt. Mineral. Zhurnal, 11(6), 3–18 (in Russian).

Te_3Se_4

An electron-microprobe analysis gave Te 54.11, Se 44.99, sum 99.10 wt%, corresponding to $Te_{2.99}Se_{4.01}$ (normalization to Se + Te = 7), ideally Te_3Se_4. In reflected light, color and reflectance are very close to those of Te. The mineral forms margins, 4–6 μm wide, between segregations of clausthalite and Te, which are intergrown with each other, sylvanite, and naumannite. These intergrowths do not exceed 50 μm in diameter, and they fill interstices among quartz grains. The mineral is inferred to have been one of the last to form, possibly metastably, as the activities of Se and Te increased during a relatively late stage of mineralization, at roughly 150–200 °C, in the Prasodov occurrence, Kurile Islands, USSR.

$(Ag,Cu)Bi_3(Se,S)_5$

Electron-microprobe analyses of four grains in two samples gave Ag 6.10, 10.15, 8.56, 5.85, Cu 2.38, –, 1.00, 2.53, Bi 59.66, 55.84, 56.80, 56.82, Pb –, 1.11, 1.09, 1.01, As –, 0.37, 0.36, 0.33, Se 27.80, 27.51, 26.76, 26.50, Te 0.20, 0.37, 0.36, 0.33, S 3.74, 3.76, 3.65, 4.55, sum 99.88, 99.11, 98.28, 97.92 wt%; the first two analyses correspond to $Ag_{0.60}Cu_{0.40}Bi_{3.01}Se_{3.73}Te_{0.02}S_{1.24}$ and $Ag_{1.01}Bi_{2.86}Pb_{0.06}As_{0.05}Se_{3.73}Te_{0.03}S_{1.26}$ (normalized to total atoms = 9), ideally $(Ag,Cu)Bi_3(Se,S)_5$. Grains do not exceed 60–80 μm. In reflected light, light gray with a bluish tint; under crossed nicols, weak bireflectance and strong anisotropy. The X-ray powder pattern is very weak because of the limited amount of material available; lines correspond to the strongest lines of pavonite. The mineral forms accumulations of isolated xenomorphic grains in quartz in proximity to Au and a mineral of composition $(Bi,As,Te,Se)_2O_3$ at the Ozernov and Rodnikov occurrences, Kamchatka, USSR. These and the Prasolov occurrence resulted from epithermal mineralization associated with magmatism of the late, island-arc stage proper in the Kurile-Kamchatka belt. The mineral is inferred to have formed as the activity of Se and Te increased at roughly 150–200 °C during a relatively late stage of mineralization.

Discussion. The authors infer that the $(Ag,Cu)Bi_3(Se,S)_5$ mineral is the Se analogue of pavonite, noting similarities in optical properties and in chemical substitutions, i.e., Cu for Ag or Pb for Bi. **E.S.G.**

$Ag_{11}FeAs_4(Se,S)_{12.5}$

V.A. Kovalenker, I.Ya. Nekrasov, S.M. Sandomirskaya, A.N. Nekrasova, V.S. Malov, V.Ya. Danchenko, M.T. Dmitriyeva (1989) Sulfide-selenide-telluride mineralization of epithermal manifestations of the Kurile-Kamchatka volcanic belt. Mineral. Zhurnal, 11(6), 3–18 (in Russian).

Electron-microprobe analyses of three grains gave Ag 51.90, 51.92, 51.15, Fe 2.90, 2.55, 2.30, As 12.94, 12.78, 12.80, Sb 0.17, 0, 0, S 6.78, 5.71, 5.63, Se 24.93, 26.74, 27.26, Te 0.56, 0.70, 0.58, sum 100.18, 100.40, 99.72 wt%, corresponding to $Ag_{11.26}Fe_{1.21}As_{4.04}Sb_{0.03}(Se_{7.39}Se_{4.95}Te_{0.10})_{\Sigma 12.44}$, $Ag_{11.44}Fe_{1.09}As_{4.06}(Se_{8.05}S_{4.23}Te_{0.13})_{\Sigma 12.41}$, and $Ag_{11.25}Fe_{0.99}As_{4.09}(Se_{8.26}S_{4.20}Te_{0.11})_{\Sigma 12.55}$ (normalized to total atoms = 29), ideally $Ag_{11}FeAs_4(Se,S)_{12.5}$. In reflected light, similar to tetrahedrite-tennantite: gray, with hardly noticeable rose tint, darker than hessite and close to naumannite. Under crossed nicols, isotropic, polishes well. The mineral occurs in the sulfide-selenide-telluride mineralization of the Prasolov occurrence, Kurile Islands, USSR, which resulted from epithermal mineralization associated with the magmatism of the late, island-arc stage proper in the Kurile-Kamchatka belt. The mineral occurs in relict segregations 20–50 μm in diameter within paratellurite. In places the mineral is surrounded by a narrow rim of naumannite, and commonly it encloses tiny inclusions of chalcopyrite. The mineral is inferred to have formed as the activity of Se increased at roughly 150–100 °C during a relatively late stage of mineralization. **E.S.G.**

θ-Al_2O_3, δ-Al_2O_3

Ch. Siegert, A.L. Shirokov, L.V. Nikishova, L.A. Pavlova, O.A. Babiy (1990) Natural analogues of the alumina modifications (δ-Al_2O_3 and θ-Al_2O_3) in permafrost-area sediments. Doklady Akad. Nauk SSSR, 313, 689–692 (in Russian).

Electron-microprobe analyses of θ-Al_2O_3 and of associated δ-Al_2O_3 and corundum gave Al_2O_3 83–87, impurities <1 wt%, whereas laser microspectroscopy detected only Al. The low analytical totals are attributed to the high microporosity of the analyzed material. Refractive indices of θ-Al_2O_3 and of associated δ-Al_2O_3 and corundum range from 1.69 to 1.74, and birefringence is <0.006. An X-ray powder diagram for θ-Al_2O_3 gave well-defined, intense reflections, of which the strongest (28 given) are 2.88(40), 2.71(60), 2.42(40), 2.28(30), 2.01(40), 1.537(30), and 1.386(100) Å. The pattern agrees in *d* values and relative intensities with the standard pattern for θ-Al_2O_3 (PDF 4–875).

For δ-Al_2O_3, an X-ray powder diagram gave weak, washed-out lines as follows: 2.76(20), 2.59(10), 2.43(30), 2.30(20), 2.11(10), 2.01(30), 1.96(20), 1.52(10), and

1.39(100) Å, which agree in *d* values and relative intensities with the most intense lines in a standard pattern for δ-Al_2O_3 (PDF 16–384), lacking only one line with $I \geq 50$. The minerals form yellowish, polycrystalline spherules about 0.1 mm in diameter that, together with corundum, constitute 2–3% of the heavy fraction of minerals separated from loam and sandy loam of upper Pleistocene to Holocene age in different areas of Yakutiya, USSR. These sediments were frozen during deposition in river valleys and on gentle slopes. The spherules of Al_2O_3 are confined to layers with well-defined features of cryogenic soil formation. The formation of metastable modifications of Al_2O_3 is attributed to the dehydration of colloidal aluminum hydroxides at subfreezing temperatures maintained over an extended period in the presence of saline pore solutions; crystallization pressure is exerted by growing ice crystals.

Discussion. The material used in this study was obtained from natural exposures and from cores out of drillholes, all located in uninhabited areas. The samples were prepared by elutriation. Consequently, the authors exclude the possibility of contamination by synthetic substances. **E.S.G.**

Ralstonite-like

W.D. Birch, A. Pring (1990) A calcian ralstonite-like mineral from the Cleveland Mine, Tasmania, Australia. Mineral. Mag., 54, 599–602.

The mineral occurs as colorless to white octahedral crystals, up to 2 mm across, in an assemblage containing morinite, gearksutite, potassium feldspar, siderite, and vivianite that encrust quartz and fluorite in specimens from the former Cleveland tin mine near Waratah, Tasmania. Electron-microprobe analyses gave Al 6.21, 6.13, Mg 15.09, 15.28, Ca 8.71, 8.83, Na 14.12, 14.15, P 0.53, 0.36, F 49.16, 49.27, O 5.25, 4.76, H (calc.) 0.18, 0.14, sum 99.25, 98.92 wt%, the first corresponding to $(Na_{1.47}Ca_{0.52})_{\Sigma 1.99}(Mg_{1.49}Al_{0.55}P_{0.04})_{\Sigma 2.08}F_6[(OH)_{0.43}O_{0.36}F_{0.21}]_{\Sigma 1.00}$. Refractive index 1.40, $D_{meas} = 2.99(1)$, $D_{calc} = 3.06$ g/cm³. X-ray single-crystal study showed strong streaking, indicating strong disorder and the possibility of small compositional domains. A 57.3-mm Gandolfi pattern (Co radiation) gave strongest lines of 2.906(100,222), 2.314(50, 331), 1.940 (20, 511), 1.783 (60, 440), and 1.524(50,622), $a = 10.081(3)$ Å. Compared to the general ralstonite formula $Na_x(Al_{2-x}Mg_x)(F,OH)_6 \cdot H_2O$, the Tasmanian mineral can be visualized as $Na_2Mg_2(F,OH)_6 \cdot H_2O$ but with substitution of Ca+(OH,O,F) for H_2O and Na+Mg for Al. **J.L.J.**

$PbCO_3 \cdot PbO$

A. Pring, W.D. Birch, A. Reller (1990) An occurrence of lead oxycarbonate ($PbCO_3 \cdot PbO$) as a mine fire product at Broken Hill, New South Wales. Mineral. Mag., 54, 647–649.

The compound occurs as white, clay-like, slightly waxy pseudomorphs after cerussite and as irregular patches on specimens of old fill material (i.e., not in situ) now found at the Kintore open pit, Broken Hill, New South Wales. Electron-microprobe and TG–EG analyses gave PbO 90.4, SO_3 0.1, CO_2 9.7, sum 100.2 wt%, corresponding to $Pb_{1.91}C_{1.04}O_4$, ideally $PbCO_3 \cdot PbO$, which is known as a phase formed in the thermal decarbonatization of lead carbonate. Indexing of the Guinier-Hägg powder pattern (100-mm diameter, Cu radiation) led to an orthorhombic cell, $a = 9.323(9)$, $b = 8.996(9)$, $c = 5.143(6)$ Å; strongest lines of the pattern are 4.118(50,210), 4.007(60,111), 3.220(100,211), 3.175(100,121), 2.857(50,130), and 2.569(35,002). The compound is thought to have formed by the roasting of cerussite during underground mine fires early in 1906.

Discussion. Although it would seem that the lack of an in situ occurrence would negate the possibility that the oxycarbonate be accepted as a new mineral, the CNMMN ruled that the compound is not a mineral because it formed as the result of an artificial process (the mine fires). This poses an interesting question in that several new minerals formed as the result of burning of coal dumps have been accepted recently. Although the fires apparently start by spontaneous combustion, the circumstances that lead to the combustion clearly are manmade and artificial. The line is obviously a fine one. What about romarchite and hydroromarchite, which formed on manmade archeological (pewter) objects? These comments are philosophical and are not intended to second-guess the difficult decisions faced by the CNMMN. **J.L.J.**

Cu-Al analogues of honessite, hydrohonessite

A. Livingstone (1990) Copper-aluminium analogues of hydrohonessite and honessite, and woodwardite relationships. Mineral. Mag., 54, 649–653.

Specimens from one of the dumps near an old nickel mine (pyrrhotite, pentlandite, chalcopyrite) at Craignure, Scotland, have blue-green, multilayer coatings and pocket linings of [microcrystalline to cryptocrystalline] honessite-like and hydrohonessite-like coatings. Some of the collomorphic layers in the coatings are less than 1 μm wide. Electron-microprobe analyses, of areas for which X-ray powder patterns were taken, show a wide variation in compositions in which Cu nearly always exceeds Ni, and Al exceeds Fe; substantial Si (commonly double-digit values) is present in many of the analyses and is attributed to amorphous allophane. Infrared spectra gave absorption bands characteristic for water, and sulfate > carbonate. X-ray powder patterns (114.6-mm camera, Fe radiation) gave broad lines and high backgrounds; for the hydrohonessite-like phase the six lines listed are 11.3(100,003), 5.67(10,006), 3.80(10,009), 2.61(15,101,012), 2.45(10, 015), and 1.50(5,110) Å, corresponding to $a = 3.00$, $c = 32.4$; no X-ray data are given for the honessite-like phase. **J.L.J.**

Unnamed iron silicide

V.K. Marshintsev (1990) Natural silicon carbide in kimberlitic rocks of Yakutiya. Mineral. Zhurnal, 12(3), 17–26 (in Russian).

Electron-microprobe analyses gave Si 56.87, Fe 44.17, sum 101.04 wt%. The X-ray powder pattern has lines at 5.12(10), 2.381(20), 1.897(30), 1.859(100), 1.337(<10), 1.168(<10), 1.086(20), and 1.062(10) Å. The mineral occurs as rare inclusions in moissanite in kimberlite at Yakutiya, USSR.

Discussion. Available information does not exclude the possibility that the $FeSi_2$-bearing moissanite resulted from contamination by carborundum used in preparing the samples for study. A compound Fe_3Si_7 (Si 54.09, Fe 45.9, P 0.1, Al 0.1, Mn 0.7, sum 101.7 wt%) was reported by Essene and Fisher to occur in a fulgurite (*Science,* 234, 189–193, 1986). Data for inclusions approximating $FeSi_{2.3}$ were abstracted in *Am. Mineral.,* 76, p. 301, 1991. **E.S.G.**

New Data

Alvanite

P.J. Dunn, A.C. Roberts, F. Pertlik (1990) Alvanite from Kazakhstan, U.S.S.R.: new crystallographic and chemical data. Mineral. Mag., 54, 609–611.

Pertlik, F., Dunn, P.J. (1990) Crystal structure of alvanite, $(Zn,Ni)Al_4(VO_3)_2(OH)_{12}\cdot 2H_2O$, the first example of an unbranched *zweier*-single chain vanadate in nature. Neues Jahrb. Mineral. Mon., 385–392.

Electron-microprobe analysis gave Al_2O_3 34.2, FeO 0.3, ZnO 7.6, NiO 4.2, V_2O_5 27.5, H_2O (by difference) 26.2, sum 100 wt%, corresponding to $Al_{8.18}Fe_{0.05}Zn_{1.14}Ni_{0.68}V_{3.68}O_{40.99}$, ideally $(Zn,Ni)Al_4(VO_3)_2(OH)_{12}\cdot 2H_2O$. $D_{meas} = 2.49$, $D_{calc} = 2.492$ g/cm³ for the ideal formula with $Z = 2$ and Zn:Ni = 1.70:1. X-ray single-crystal study gave monoclinic symmetry, space group $P2_1/n$, $a = 17.808(8)$, $b = 5.132(3)$, $c = 8.881(4)$ Å, $\beta = 92.11(3)°$ as refined from a 114.6-mm Gandolfi pattern (Cu radiation) with strongest lines of 8.91(90,200), 7.85(80,101), 5.02(50,$\bar{3}$01), 4.46(100,400), 3.287(45,112), 2.957(45,$\bar{3}$12), and 1.481 (50,033,006). Crystal-structural study ($R = 0.056$) confirmed the presence of (VO_3) groups. The unit cell and formula are new. **J.L.J.**

Amarillite

Jia-Ju Li, Jing-Liang Zhou, Wei Dong (1990) The structure of amarillite. Chinese Science Bulletin, 35(24), 2073–2075 (in English).

X-ray single-crystal structural study ($R = 0.0374$) of amarillite, $NaFe^{2+}(SO_4)_2\cdot 6H_2O$, from Qinghai Province, China, gave monoclinic symmetry, space group $C2/c$, $a = 8.4190(61)$, $b = 10.8409(40)$, $c = 12.4717(50)$ Å, $\beta = 95.495°$, $D_{calc} = 2.2217$ g/cm³ with $Z = 4$. The cell and space group are new. **J.L.J.**

Georgeite

A.M. Pollard, R.G. Thomas, P.A. Williams, J. Just, P.J. Bridge (1991) The synthesis and composition of georgite and its reactions to form other secondary copper (II) carbonates. Mineral. Mag., 55, 163–166.

Chemical analyses of synthetic georgeite gave CuO 72.3, 71.0, CO_2 20.0, 19.7, H_2O 7.7, 9.3, sum 100.0, 100.0 wt%. Analysis of georgeite from the Carr Boyd mine, Western Australia, gave Cu 71.0, CO_2 20.1, H_2O 9.5, sum 100.6 wt%; the requirements for the formula $Cu_2CO_3(OH)_2$ are CuO 71.9, CO_2 19.9, H_2O 8.2 wt%. Comparison of the infrared spectra of the synthetic compound and of georgeite from the Carr Boyd mine and the Britannia mine, Wales, showed them to be identical. The results indicate that georgeite is the amorphous analogue of malachite, $Cu_2CO_3(OH)_2$. Revision of the formula was approved by the CNMMN. **J.L.J.**

Kamchatkite

T.V. Varaksina, V.S. Fundamensky, S.K. Filatov (1990) The crystal structure of kamchatkite, a new naturally occurring oxychloride sulphate of potassium and copper. Mineral. Mag., 54, 613–616.

Single-crystal X-ray structural study ($R = 0.055$) of kamchatkite [abs., *Am Mineral.* 75, p. 1210, 1990], gave orthorhombic symmetry, space group $Pna2_1$. The space group is new. **J.L.J.**

Lovdarite

S. Merlino (1990) Lovdarite, $K_4Na_{12}(Be_8Si_{28}O_{72})\cdot 18H_2O$, a zeolite-like mineral: structural features and OD character. Eur. J. Mineral., 2, 809–817.

Single-crystal X-ray structural study of lovdarite gave orthorhombic symmetry, space group $Pma2$, $a = 39.576(1)$, $b = 6.9308(2)$, $c = 7.1526(3)$ Å, formula $K_4Na_{12}(Be_8Si_{28}O_{72})\cdot 18H_2O$. Distinct domains and various degrees of structural disorder are present. The mineral is the first example of a framework silicate containing three-membered rings. The formula and space group are new. **J.L.J.**

Osmium, iridium, rutheniridosmine, ruthenium

D.C. Harris, L.J. Cabri (1991) Nomenclature of platinum-group element alloys: Review and revision. Can. Mineral., 29, 231–237.

Within the ternary system Os-Ir-Ru, only four names apply: *osmium* for hexagonal alloys with atomic % Os the major element; *iridium* for cubic alloys and *rutheniridosmine* for hexagonal alloys in which atomic % Ir is the major element; *ruthenium* for hexagonal alloys with Ru the major element. The new system (see also *Discredited Minerals*) was approved by the CNMMN. **J.L.J.**

Phurcalite

D. Atencio, R. Newmann, A.J.G.C. Silva, Y.P. Mascarenhas (1991) Phurcalite from Perus, São Paulo, Brazil, and redetermination of its crystal structure. Can. Mineral., 29, 95–105.

Single-crystal X-ray structural study (R = 0.038) of phurcalite gave orthorhombic symmetry, space group *Pbca*, a = 17.415(2), b = 16.035(3), c = 13.598(3) Å, D_{meas} = 4.22, D_{calc} = 4.220 g/cm³ with Z = 8. Electron-microprobe analyses and the structural study indicate that the formula is $Ca_2(UO_2)_3O_2(PO_4)_2 \cdot 7H_2O$. The formula is new. **J.L.J.**

Silicon

I. Leung, W. Guo, I. Friedman, J. Gleason (1990) Natural occurrence of silicon carbide in a diamondiferous kimberlite from Fuxian. Nature, 346, 352–354.

V.K. Marshintsev (1990) Natural silicon carbide in kimberlitic rocks of Yakutiya. Mineral. Zhurnal, 12(3), 17–26 (in Russian).

Electron-microprobe analysis of the Yakutian silicon gave nearly pure Si: 99.73 wt%. The mineral forms 6-sided crystals up to nearly 0.1 mm long in moissanite. Isotropic, transparent, transmits a reddish brown color. The X-ray powder pattern includes lines (12 given) from both the silicon and the host moissanite-*6H*; the following lines probably belong to Si: 3.134(100), 1.917(50), 1.644(10) Å. The Fuxian silicon occurs as a thin iridescent film on crystal faces of moissanite; the silicon formed at oxygen fugacities lower than that of the Si-SiO_2 buffer, and coevally with moissanite and diamond in the mantle.

Discussion. See the *Discussion* for moissanite and β-SiC. Silicon was reported in a fulgurite (Essene and Fisher, *Science,* 234, 189–193, 1986), and data for silicon from other localities were abstracted in *Am. Mineral.,* 76, p. 668, 1991. **E.S.G.**

Discredited Minerals

Iridosmine,* osmiridium,* ruthenosmiridium,* platiniridium*

D.C. Harris, L.J. Cabri (1991) Nomenclature of platinum-group element alloys: review and revision. Can. Mineral., 29, 231–237.

The consequence of the redefinition of the mineral names applicable to the Ru-Os-Ir ternary system (see osmium, etc.) is that *iridosmine, osmiridium,* and *rutheniridosmium* are no longer valid. As well, *platiniridium* is merely platinian iridium. **J.L.J.**

Erratum

In the abstract for **kazakhstanite** (V. 76, p. 662), the formula should read $Fe^{3+}_5V^{4+}_3V^{5+}_{12}O_{39}(OH)_9 \cdot 8.55H_2O$.