

New mineral names*

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ALLOCHALCOSELITE*

L.P. Vergasova, S.V. Krivovichev, S.N. Britvin, S.K. Filatov, P.C. Burns, V.V. Ananyev (2005) Allochalcoseelite, $\text{Cu}^+\text{Cu}_2^{2+}\text{PbO}_2(\text{SeO}_3)_2\text{Cl}_5$ —a new mineral from volcanic exhalations (Kamchatka, Russia). Zap. Ross. Mineral. Obshch., 134(3), 70–74 (in Russian, English abstract).

The new mineral species allochalcoseelite has been found among lead and copper selenite-chloride exhalative products associated with the fumaroles of the second cinder cone of the northern breach of the Great Tolbachik Fissure Eruption, Kamchatka Region, Russia that took place in 1975–1976. Associates include cotunnite, sophiite, ilinskite, georgbokiite, and burnsite. The mineral strongly resembles georgbokiite, except for its more elongated morphology and brighter color. Grain size is less than 0.1 mm and the total amount of material collected makes up only a few tens of millimeters. It is dark brown with a brown streak and adamantine luster, is brittle, has a Mohs hardness of 3–4, and shows perfect {100} cleavage. $D_{\text{calc}} = 4.689 \text{ g/cm}^3$. The mineral is biaxial (+), $\alpha = 1.98(1)$, $\beta = 2.01(1)$, $\gamma = 2.08(1)$, $2V_{\text{obs}} = 50(15)$, $2V_{\text{calc}} = 68(10)^\circ$; $Y = b$, $X = c$, with the pleochroic scheme X light brown, Y undetermined, Z reddish brown. The average chemical composition ($n = 21$) by electron microprobe is [oxide wt%, (std. dev.): CuO 43.96(0.49), ZnO 0.15(0.11), SeO₂ 20.66(0.37), PbO 22.34(0.40), Cl 16.58(0.26), O \equiv Cl₂ –3.75, total 99.94. The $\text{Cu}^+/\text{Cu}^{2+}$ ratio and empirical formula were calculated on a basis of 9(Cu, Zn, Se, Pb) and 13(O, Cl), giving $\text{Cu}_{1.00}^{+}\text{Cu}_{4.92}^{2+}\text{Pb}_{1.07}\text{Se}_{1.99}\text{O}_{7.99}\text{Cl}_{5.01}$, and thus the ideal formula $\text{Cu}^+\text{Cu}_2^{2+}\text{Pb}^{2+}\text{O}_2(\text{SeO}_3)_2\text{Cl}_5$. X-ray powder study with a 57.3 mm Debye camera ($\text{CuK}\alpha$) gave the following strongest diffraction maxima (d Å, $I\%$; hkl): (3.86, 80; 11 $\bar{3}$), (3.55, 80; 311), (3.08, 100; 60 $\bar{2}$, 020), (1.710, 30; 802), (1.543, 50; 334, 82 $\bar{8}$, 10 $\bar{2}$ 6), (1.448, 30; 441, 120 $\bar{8}$), (1.349, 40; 82 $\bar{1}$ 0). Single-crystal X-ray diffractometry gave $a = 18.468(2)$, $b = 6.1475(8)$, $c = 15.314(2)$ Å, $\beta = 119.284(2)^\circ$, space group $C2/m$, $Z = 4$. The crystal structure is novel; it includes distinctly ordered Cu^+ and Cu^{2+} positions, with Cu^+ linearly coordinated by Cl^- ions, and Cu^{2+} coordinated by O^{2-} and Cl^- ions. The copper and lead atoms are hosted by oxocentric OCu_4^{2+} and $\text{OCu}_3^{2+}\text{Pb}^{2+}$ tetrahedra that are corner-linked into chains along b . The chains

are interconnected by SeO_3 groups to form (100) layers; Cl^- ions and CuCl_2 dumbbells cross-link adjacent layers. The mineral is one of a tiny number of natural and synthetic compounds known to contain ordered arrangements of uni- and divalent copper (includes paramelaconite and $\text{Cu}^+\text{Cu}_2^{2+}\text{O}[\text{SeO}_3]\text{Cl}_5$). The name is compositional and is derived from the Greek, $\alpha\lambda\lambda\omicron\varsigma$ (“different”) + $\chi\alpha\lambda\kappa\omicron\varsigma$ (“copper”) + $\sigma\epsilon\lambda\eta\iota\nu\eta$ (“selenium”), to reflect the different valences and crystallographic behavior of copper in this selenite mineral.

Discussion. No mention is made of a sample number, where the type sample is deposited (perhaps the Mineralogical Museum, Department of Mineralogy, St. Petersburg State University?), or whether any of the tiny quantities of type material remain after testing. **T.S.E.**

BIRAITE-(CE)*

A. Konev, M. Pasero, D. Pushcharovsky, S. Merlino, A. Kashaev, L. Suvorova, Z. Ushchapovskaya, N. Nartova, Y. Lebedeva, N. Chukanov (2005) Biraite-(Ce), $\text{Ce}_2\text{Fe}^{2+}(\text{CO}_3)(\text{Si}_2\text{O}_7)$, a new mineral from Siberia with a novel structure type. Eur. J. Mineral., 17, 715–721.

Biraite-(Ce) occurs as irregular shaped grains from 0.1 to 3 mm in maximum dimension, sometimes as brittle well-shaped crystals and also as intergrowths. The mineral is brown (megascopic) to light gray (when powdered), with a white streak. Microindentation measurements (Vickers) with gave a mean value of 777 kg/mm², corresponding to a Mohs hardness of 5. The mineral is brittle and soluble in strong acids. Electron microprobe analyses of biraite-(Ce) (8 analyses) gave SiO₂ 21.07, TiO₂ 0.17, FeO 7.68, MnO 1.39, MgO 1.81, CaO 0.66, Na₂O 0.10, BaO 0.24, La₂O₃ 16.52, Ce₂O₃ 29.58, Nd₂O₃ 7.53, Pr₂O₃ 2.71, Sm₂O₃ 0.70, F 0.58, CO₂ 7.71, H₂O 1.71, sum 99.92 wt%, corresponding to $[(\text{Ce}_{1.01}\text{La}_{0.57}\text{Nd}_{0.25}\text{Pr}_{0.09}\text{Sm}_{0.02})_{\Sigma=1.94}\text{Ca}_{0.07}\text{Na}_{0.02}\text{Ba}_{0.01}]_{\Sigma=2.04}(\text{Fe}_{0.60}\text{Mg}_{0.25}\text{Mn}_{0.11}\text{Ti}_{0.01})_{\Sigma=0.97}(\text{CO}_3)_{0.99}[\text{Si}_{1.97}(\text{O}_{6.87}\text{F}_{0.17})_{\Sigma=7.04}]$ based on the sum of 10 total anions (O+F). The CO₂ content was determined by wet chemical methods. The ideal formula is $\text{Ce}_2\text{Fe}^{2+}(\text{CO}_3)(\text{Si}_2\text{O}_7)$. Biraite-(Ce) is light brown, nearly clear in plane-polarized light, and non-pleochroic. It is biaxial negative with $2V_{\text{meas}} = 66(1)^\circ$, $2V_{\text{calc}} = 64^\circ$, $\alpha = 1.785(1)$, $\beta = 1.810(2)$, $\gamma = 1.820(1)$. The dispersion is $r < v$, weak. The IR spectrum of biraite-(Ce) shows absorption bands at 3350 (H₂O stretching), 1735 (CO₃ bending), 1465, 1373 (CO₃ stretching), 1090, 1065, 1010 (Si-O-Si stretching), 966, 938, 921, 893 (Si-O stretching), 853, 840 (out of plane CO₃), 658, 547, 499 cm⁻¹ (O-Si-O bending).

The crystal structure of biraite-(Ce) was solved and refined by

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single-crystal X-ray diffraction methods, using a crystal $0.18 \times 0.03 \times 0.03$ mm, to $R1 = 0.033$ for 9656 reflections. The mineral is monoclinic, $P2_1/c$, $a = 6.505(7)$, $b = 6.744(2)$, $c = 18.561(4)$ Å, $\beta = 108.75(2)^\circ$, $V = 771.1(2)$ Å³, $Z = 4$, $D_{\text{calc}} = 4.76$ g/cm³, $\mu = 13.91$ mm⁻¹. The strongest lines on the X-ray diffraction pattern (DRON UM-1, and Fe-filtered $\text{CoK}\alpha$ radiation, 24 lines) include 4.54(30,110), 4.41(40,102), 4.28(20,10 $\bar{4}$), 4.16(30,111), 3.68(30,014), 3.61(40,11 $\bar{4}$), 3.30(50,021), 3.14(40,022), 3.02(20,20 $\bar{4}$), 2.92(100,006,21 $\bar{2}$), 2.76(20,21 $\bar{4}$), 2.67(30,024), 2.65(50,202,12 $\bar{4}$), 2.23(50,116,031), 2.15(20,30 $\bar{2}$), 2.10(30,125), 2.04(20,21 $\bar{8}$), 1.652(20,042). Biraite-(Ce) displays an unprecedented structure type and has no mineral or synthetic analogs. It is the second known example of a mixed-anion compound with $[\text{Si}_2\text{O}_7]$ and $[\text{CO}_3]$ groups, besides tilleyite.

Biraite-(Ce) was discovered at the Biraia deposit in one of the veins of carbonate rocks among the fenites of Biraia carbonatite dyke. It is located in the basin of the Biraia River, 145–150 km east of the city of Bodaibo, in the Northern region of the Irkutsk district, Siberia, Russia. The vein was found within coarse fenite fragments, approximately 50 m from the carbonatite body. It is associated with cordylite-(Ce) and -(La), aragonite, dolomite, ancylite-(Ce) and -(La), hydroxyl-bastnäsite-(Ce), daqing-shanite-(Ce) and -(La), tremolite, winchite, ferriallanite-(Ce), törnebohmit-(Ce), cerite, chevkinite-(Ce), belkovite, humite, fergusonite-(Ce) and -(Nd), pyrochlore, barite, monazite-(Ce), and other unknown minerals. The mineral is named after the type locality Biraia, plus the Levinson modifier for the dominating REE. The type material has been deposited at the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow (catalog no. 91375). **R.R.**

CLEUSONITE*

P.-A. Wülser, N. Meisser, J. Brugger, K. Schenk, S. Ansermet, M. Bonin, F. Bussy (2005) Cleusonite, $(\text{Pb,Sr})(\text{U}^{4+}\text{U}^{6+})(\text{Fe}^{2+}, \text{Zn})_2(\text{Ti,Fe}^{2+},\text{Fe}^{3+})_{18}(\text{O,OH})_{38}$, a new mineral species of the crichtonite group from the western Swiss Alps. *Eur. J. Mineral.*, 17, 933–942.

Cleusonite is found in metamorphic rocks of the central Swiss Alps. The type locality consists of Oligocene-Miocene alpine cleft veins near Cleuson, Val de Nendaz, Valais. The following minerals are also found in the veins: quartz, chlorite, calcite, albite, microcline, tourmaline, fluorapatite, zircon, ilmenite, hematite, titanite, pyrite, chalcopyrite, tennantite, rutile, crichtonite, monazite-(Ce), and gold. Clausthalite, chalcopyrite, and uraninite occur as inclusions in the cleusonite, which occurs as single and twinned crystals to 2–3 cm in diameter. Cleusonite has also been found in gneisses and crosscutting alpine cleft veins near the Bella Tolla summit, also in Valais. Here it occurs as hematite-stained flattened aggregates with quartz, albite, barite, chalcopyrite, uraninite, tennantite, pyrite, hematite, magnetite, cinnabar, and malachite. Type cleusonite is opaque black with a black streak and submetallic luster and has a Mohs hardness of 6–7. Cleavage was not observed, but there is a conchoidal fracture and it is brittle. The mineral is light gray to white in reflected light, and is not birefractant due to its partly metamict character. Key reflectance values in air are (λ nm, $R\%$): (400, 21.2), (480, 18.3), (540, 17.5), (580, 17.4), (640, 17.4), (700, 17.3). It is para-

magnetic. Density is 4.74(4) (meas.), 4.93(12) (corr. for volume expansion with metamictization), 5.02(6) (calc., unheated) and 5.27 g/cm³ (calc., heated crystals). Crystals are complex; major forms include $\{001\} > \{100\}$, $\{110\} > \{012\} > \{101\}$, $\{104\}$. Most crystals are twinned on planes parallel to $[001]$; interpenetration twins based on $\sim 30^\circ$ rotations about $[001]$ are common. The average chemical analysis by EMPA, XPS, FTIR, TGA, and wet spectro-colorimetry is Al_2O_3 0.16, TiO_2 44.55, V_2O_5 0.83, MnO 0.28, FeO 18.13, Fe_2O_3 8.81, ZnO 0.33, SrO 0.6, PbO 9.34, UO_2 10.07, UO_3 4.12, H_2O 1.11, total 98.33 wt%. The formula per 22 cations and 38 anions (with O:OH calculated for charge balance) is $(\text{Pb}_{0.89}\text{Sr}_{0.12})_{\Sigma 1.01}(\text{U}_{0.79}\text{U}_{0.30})_{\Sigma 1.09}(\text{Fe}_{1.91}\text{Zn}_{0.09})_{\Sigma 2.00}(\text{Ti}_{11.80}\text{Fe}_{3.44}\text{Fe}_{2.33}\text{V}_{0.19}\text{Mn}_{0.08}\text{Al}_{0.07})_{\Sigma 17.90}[\text{O}_{35.37}(\text{OH})_{2.63}]_{\Sigma 38}$. The ideal formula is $\text{Pb}(\text{U}^{4+},\text{U}^{6+})\text{Fe}_2(\text{Ti,Fe}^{2+},\text{Fe}^{3+})_{18}(\text{O,OH})_{38}$. Cleusonite is a new member of the crichtonite group, the first member of the group with U dominant at the B position of the formula. It is hexagonal, $R\bar{3}$, a 10.576(3), c 21.325(5) Å (single crystal, unheated), or a 10.385(2), c 20.900(7) Å (same crystal, heated at 800 °C for 18 h). The strongest lines in the diffraction pattern of the *unheated* sample are (d Å, 1% ; hkl): (3.31, 19; 122), (2.957, 16; 116), (2.820, 100; 303), (2.450, 38; 312), (2.137, 21; 226), (2.081, 15; 1010), (1.485, 33; 342). The strongest lines in the pattern of the *heated* sample are: (6.83, 51; 012), (5.18, 52; 110), (3.406, 96; 024), (3.064, 46; 205), (2.995, 53; 300), (2.893, 100; 116), (2.851, 69; 214), (2.245, 55; 134). The name of the mineral is for the type locality. Holotype crystals are stored at the Geological Museum of Lausanne, Switzerland (MGL 65200 to 65205). Cotypes are stored at the National Museum of Natural History, Paris France (MNHN 203.64 to 203.66). **T.S.E.**

2COO·AS₂O₅·SiO₂·2H₂O

K. Walenta, T. Theye (2005) A new cobalt mineral from the Sophia mine near Wittichen, Central Black Forest. *Der Erzgräber*, 19, 51–57 (in German with English abstract).

A new unnamed cobalt mineral belongs to the secondary assemblage of the Sophia mine near Wittichen, Central Black Forest, Germany. It is associated with pink to whitish crusts and spherulitic aggregates of erythrite (containing distinct amounts of Ni, some Mg, and minor Ca), barite, and quartz; the latter two being intergrown with altered granite. The sample was found underground in 1978. The mineral forms hair-like curved crystals that occur as loose efflorescences on erythrite. The crystals are up to 1.2 mm in length and up to 0.02 mm in width; their ruler-like shape suggests orthorhombic symmetry, but distinct forms are lacking. The mineral is colorless to slightly pink, has a white streak, is transparent, and shows vitreous luster. It is flexible, with an estimated Mohs hardness of 1–2. No cleavage was observed. D_{calc} is 3.26 g/cm³. Optical properties: $\alpha = 1.611(3)$, β = close to α , $\gamma = 1.652(3)$, straight extinction, length-slow, very weakly pleochroic. The mineral is quickly soluble in 1:1 HCl. The only lines on the unindexed powder pattern (57.3 mm camera, $\text{FeK}\alpha$ radiation, intensities visually estimated) include: 10.39 (10), 7.21 (8; very diffuse), 3.27 (6), 3.09 (6), 2.87 (8), 1.975 (0.5), 1.652 (4), 1.495 (0.5). The pattern indicates low crystallinity. Electron microprobe analyses gave (average of five analyses; beam size not indicated): MgO 1.21, CaO 5.19, CoO 16.51, NiO 6.10, MnO 0.95, As₂O₅ 46.98, SiO₂ 13.91, H₂O 9.15 (by differ-

ence), sum 100.00 wt%, corresponding to the empirical formula $\text{Mg}_{0.14}\text{Ca}_{0.42}\text{Co}_{1.00}\text{Ni}_{0.37}\text{Mn}_{0.06}\text{As}_{1.85}\text{Si}_{1.05}\text{H}_{4.60}\text{O}_{11}$, on the basis of eleven O atoms. A simplified formula $2\text{CoO}\cdot\text{As}_2\text{O}_5\cdot\text{SiO}_2\cdot 2\text{H}_2\text{O}$ is suggested. Lack of suitable material and unsuccessful indexing of the powder pattern precluded a full and more accurate description of the mineral, and therefore the authors did not submit a proposal to the CNMMN IMA. **U.K.**

FERRIWINCHITE*

A.G. Bazhenov, A.B. Mironov, V.A. Muftakhov, P.V. Khvorov (2005) Ferriwinchite $\text{NaCaMnFe}^{3+}[\text{Si}_8\text{O}_{22}](\text{OH},\text{F})_2$ —a new amphibole-group mineral (Ilmen Mountains alkaline complex, Southern Urals). *Zap. Ross. Mineral. Obshch.*, 134(3), 74–77 (in Russian, English abstract).

Ferriwinchite, the Fe^{3+} analog of winchite, is one of many amphibole-group minerals in late veins in the fenite halo of the Ilmen Mountains alkaline complex, Russia. The amphibole composition depends strongly on the composition of the rocks that host these veins; ferriwinchite and ferrian winchite occur in veins intersecting agpaitic pyroxene fenite, pyroxene syenite, and pyroxene-feldspar syenitic pegmatites. The type sample of ferriwinchite comes from a fenite-hosted vein in the middle part of the Ilmen Preserve, 1 km east of the Selyankinsky cordon. It occurs both as thin borders on crystals of ferrian winchite and as finely acicular individuals dominated by $\{110\}$ prisms. Ferriwinchite is black with a greenish gray streak and glassy luster, is untwinned, shows $\{110\}$ cleavage, has a hackly fracture, and Mohs hardness of 5.5. In immersion mounts it is transparent when less than 0.3 mm thick; pleochroism is c dark blue, b lilac, and perpendicular to the bc plane, bright brownish yellow; absorption is $c = b > a$; $\alpha = 1.675(2)$, $\gamma = 1.687(2)$; optic plane (010), $Z = b$. X-ray powder diffractometry (monochromated Fe radiation) gives $a = 9.811(6)$, $b = 18.014(6)$, $c = 5.295(4)$ Å, $\beta = 104.10(6)^\circ$, space group $C2/m$. The strongest maxima in the powder diffraction pattern are (d Å, $I\%$; hkl): (8.42, 100; 020, 110), (3.391, 10; 131), (3.268, 13; 240), (3.116, 60; 310), (2.800, 10; 330), (2.711, 20; 151). The chemical composition by electron microprobe (average for 5 grains) is: SiO_2 54.90, TiO_2 0.11, Al_2O_3 1.11, FeO 15.91, MnO 0.76, MgO 14.17, CaO 5.10, Na_2O 5.18, K_2O 0.51, total 97.76 wt%, giving the empirical formula $(\text{Na}_{0.21}\text{K}_{0.09})_{0.30}(\text{Ca}_{0.78}\text{Na}_{1.22})_{\Sigma 2}(\text{Mg}_{3.01}\text{Mn}_{0.09}\text{Fe}_{0.85}^{2+}\text{Ti}_{0.01}\text{Fe}_{1.04}^{3+})_{\Sigma 5}(\text{Si}_{7.81}\text{Al}_{0.19})_{\Sigma 8}\text{O}_{22}(\text{OH},\text{F})_2$ (basis of 13 ($M+T$) cations and 23 effective oxygen atoms), or ideally $\square\text{NaCaMg}_4\text{Fe}^{3+}[\text{Si}_8\text{O}_{22}](\text{OH})_2$. $D_{\text{calc}} = 3.14 \text{ g/cm}^3$. Mössbauer spectroscopic studies indicate the following site distributions for Fe: $\text{Fe}^{2+}(\text{M1})$ 30.6, $\text{Fe}^{2+}(\text{M3})$ 10.8, $\text{Fe}^{2+}(\text{M2})$ 3.5, $\text{Fe}^{2+}(\text{M2})$ 55.1 at% (300 K). The Gladstone-Dale compatibility index, $1 - K_p/K_c$, is 0.020 (excellent). Type material has been deposited with the Natural Science Museum of the Ilmen Preserve, Urals Division of the Russian Academy of Science (catalog no. 8987).

Discussion. The paper presents abundant data for the ferrian winchite associated with ferriwinchite. Although it would seem that determinations of the H_2O and F contents of ferriwinchite were not made, the ratio of F:OH for the associated ferrian winchite is 0.23:1 **T.S.E.**

FERROROSEMARYITE*

F. Hatert, P. Lefèvre, A.-M. Fransolet, M.-R. Spirlet, L. Rebbouh, F. Fontan, P. Keller (2005) Ferrorosemaryite, $\text{NaFe}^{2+}\text{Fe}^{3+}\text{Al}(\text{PO}_4)_3$, a new phosphate mineral from the Rubindi pegmatite, Rwanda. *Eur. J. Mineral.*, 17, 749–759.

The mineral occurs as large, anhedral grains up to 3 mm embedded in scorzalite. It is transparent, dark-green to bronze color, has a resinous luster, a greenish-brown streak, is non-fluorescent, brittle, shows perfect $\{010\}$ and good $\{\bar{1}01\}$ cleavages, and has a Mohs hardness of 4. Ferrorosemaryite is biaxial negative, $\alpha = 1.730(5)$, $\beta = 1.758(7)$, and $\gamma = 1.775(5)$, pleochroism $X = \text{dark green}$, $Z = \text{dark brown}$, $2V_{\text{meas}} 82(1)^\circ$. The dispersion is strong, $r < v$.

Electron microprobe analyses (WDS, average of 9 analyses) gave P_2O_5 46.00, Al_2O_3 9.12, Fe_2O_3 21.01, FeO 11.10, MgO 0.19, MnO 7.96, CaO 0.44, Na_2O 2.85, K_2O 0.01, sum 98.68 wt%, corresponding to $\square_{1.00}(\text{Na}_{0.42}\text{Mn}_{0.28}\text{Ca}_{0.04}\square_{0.26})_{\Sigma 1.00}(\text{Fe}_{0.71}\text{Mn}_{0.24}\text{Fe}_{0.05}^{3+})_{\Sigma 1.00}\text{Fe}_{1.00}^{3+}(\text{Al}_{0.82}\text{Fe}_{0.16}\text{Mg}_{0.02})_{\Sigma 1.00}[(\text{P}_{0.99}\square_{0.01})\text{O}_4]_3$ on the basis of 12 O^{2-} . The ideal formula for ferrorosemaryite is $\square\text{NaFe}^{2+}\text{Fe}^{3+}\text{Al}(\text{PO}_4)_3$. Fe^{2+} and Fe^{3+} were calculated from the ^{57}Fe Mössbauer spectrum and gave 63% Fe^{3+} and 37% Fe^{2+} . The Mössbauer spectrum (85 K) of ferrorosemaryite was fit with three Fe^{3+} doublets and two Fe^{2+} doublets, with hyperfine parameters in good agreement with those for other alluaudite-type compounds. The infrared spectrum of ferrorosemaryite also shows similarities with other alluaudite-type compounds, with stretching vibrational modes of PO_4 tetrahedra at 1200–900 cm^{-1} , PO_4 bending vibrations, AlO_6 and FeO_6 stretching vibrational modes between 650 and 400 cm^{-1} , and a band at 3375 cm^{-1} corresponding to the stretching vibration of OH- groups at the apex of HPO_4^{2-} tetrahedra.

The structure of ferrorosemaryite was refined by single-crystal X-ray diffraction methods on a $0.10 \times 0.15 \times 0.20$ mm crystal using starting atomic coordinates of ferrowyllieite [Moore and Molin-Case (1974), *Am. Mineral.*, 59, 280–290], $R_1 = 0.0243$ for 2072 reflections with $F_o > 4\sigma(F_o)$. Ferrorosemaryite is monoclinic, $P2_1/n$, $a = 11.838(1)$, $b = 12.347(1)$, $c = 6.2973(6)$ Å, $\beta = 114.353(6)^\circ$, $V = 838.5(1)$ Å³. The strongest lines on the powder X-ray diffraction pattern include 8.102(30,110), 6.167(50,020), 5.382(40,200), 4.054(45,220), 3.448(65,310), 3.011(40,11 $\bar{2}$), 2.867(15,002), 2.821(20,31 $\bar{2}$), 2.785(15,22 $\bar{2}$), 2.693(75,400), 2.677(100,240), 2.468(20,420), 2.123(15,510), 2.050(15,31 $\bar{3}$,53 $\bar{1}$), and 1.910(15,530). The crystal structure of ferrorosemaryite is isostructural with other phosphates of the wylleite group and consists of kinked chains of edge-sharing octahedra stacked parallel to $\{101\}$. These chains are made up of $(\text{Fe},\text{Al})\text{O}_6$ pairs linked by highly distorted FeO_6 octahedra. Chains are connected in the b direction by the PO_4 tetrahedra to form sheets perpendicular to $[010]$ and channels parallel to c which contain large X cations (Mn, Na). Ferrorosemaryite is the Fe^{2+} analog of rosemaryite, $\square\text{NaMnFe}^{3+}\text{Al}(\text{PO}_4)_3$, and the Fe^{2+} analog of ferrowyllieite, $\text{Na}_2\text{Fe}_2^{2+}\text{Al}(\text{PO}_4)_3$.

Ferrorosemaryite was found in the Rubindi-Kabilizi pegmatite, located 3 km WNW of Muhororo village, south of the Rubindi river, 50 km west of Kigali, Rwanda. The pegmatite cuts

across dark-gray schists and quartzites of the Mesoproterozoic Kibuye formation. Very little remains of pegmatites in the Gatumba field, once mined for its cassiterite and columbite-tantalite ore, except open pits and barren dumps. Along with quartz, green mica, and feldspar, the mineral is associated with scorzalite, trolleite, montebasite, bertossaite, brazilianite, and accessory augelite, triplite, and lacroixite. Its name is for being the Fe²⁺-analogue of rosemeryite (IMA no. 2003-063). Type material has been deposited at the Laboratory of Mineralogy, University of Liège, Belgium (catalog no. 20326). **P.C.P.**

HOLFERTITE*

E. Sokolova, F.C. Hawthorne, D.I. Belakovskiy, L.A. Pautov (2005) The OD (order-disorder) structure of holfertite, a hydrated uranyl titanate mineral from Searle Canyon, Thomas Range, Utah, U.S.A. *Can. Mineral.*, 73, 1545–1552.

The structure of the new mineral holfertite has been published before its complete description as a new mineral (*Mineralogical Record*, in press 2006), and therefore an abstract is presented here. Holfertite is found on hematite and topaz crystals in cavities and fractures in rhyolite from Searle Canyon, Thomas Range, Utah, U.S.A. The mean of 10 and 14 electron microprobe analyses gave, respectively: CaO 3.01, 2.29; UO₃ 75.97, 76.03; TiO₂ 13.02, 11.89; Fe₂O₃ 0.47, 0.44; K₂O 0.31, 0.30; H₂O 8.59, 8.27 (calculated for 3 H₂O groups pfu), sum 101.34, 99.22 wt%. If the general formula of holfertite is considered instead to contain 0.67 OH and 3 H₂O pfu, then the calculated H₂O contents correspond to 9.51 and 9.19 wt%, and the sums are 102.29 and 100.14 wt%, respectively. On the basis of 10.5 O pfu (OH not present), the analytical data correspond to the formulae U_{1.68}⁶⁺Ti_{1.03}⁴⁺Ca_{0.34}Fe_{0.04}³⁺K_{0.04}O_{7.5}(H₂O)₃ and U_{1.74}⁶⁺Ti_{1.03}⁴⁺Ca_{0.27}Fe_{0.04}³⁺K_{0.04}O_{7.5}(H₂O)₃, respectively, ideally U_{1.75}⁶⁺Ti_{1.03}⁴⁺Ca_{0.25}O_{7.5}(H₂O)₃. On the basis of 10.84 O pfu (both OH and H₂O present), the analytical data correspond to the formulae U_{1.68}⁶⁺Ti_{1.03}⁴⁺Ca_{0.34}Fe_{0.04}³⁺K_{0.04}O_{7.17}(OH)_{0.67}(H₂O)₃ and U_{1.74}⁶⁺Ti_{1.03}⁴⁺Ca_{0.27}Fe_{0.04}³⁺K_{0.04}O_{7.17}(OH)_{0.67}(H₂O)₃, respectively, ideally U_{1.75}⁶⁺Ti_{1.03}⁴⁺Ca_{0.25}O_{7.17}(OH)_{0.67}(H₂O)₃. The infrared spectrum and the structure study are not definitive as to the presence or absence of OH in the structure; therefore, both ideal formulae are presented. Precession and Laue photographs show both sharp spots and diffuse streaks, which indicate that holfertite has an order-disorder structure. Single-crystal X-ray structure study (*R* = 0.21) confirmed the order-disorder nature of the structure, space group *P*3, *a* = 10.824(2), *c* = 7.549(2) Å, *V* = 766.0(9) Å³. The structure consists of 28 atomic sites, 20 of which constitute a U-Ti-O framework, and eight of which consist of channel sites. Only five of the framework sites are fully occupied, and all of the channel sites are partly occupied. Models of possible twinning did not lead to an improvement of the refined structure. The refinement is of relatively poor precision (and has physically unrealistic interatomic distances and coordinations), but this is stated to be in accord with its order-disorder nature, for which not all of the diffracted intensity can be accounted for by a long-range ordered model. In the general structure model, chains of uranyl polyhedra and titanium-centered polyhedra link through common vertices to form a framework with channels along [001]; the channels have an approximate diameter of 8 Å, and are interpreted to be occupied by {Ca_{0.25}(H₂O)₃} pfu. Refinement of the diffraction

data weakly supports assignment of Ca to the channels, rather than to substitution for U in the framework. The authors consider that the short-range coupling of the partial occupancies of many of the sites in holfertite is almost certainly the cause of the OD nature of the structure. The mineral corresponds to IMA mineral no. 2003-009.

Discussion. The calculated density and agreement index reported in the abstract do not agree with those given in the text and tables; data from the tables are given here. **A.J.L.**

JUANGODOYITE*

J. Schlüter, D. Pohl (2005) Juangodoyite, Na₂Cu(CO₃)₂, a new mineral from the Santa Rosa mine, Atacama desert, Chile. *N. Jb. Miner. Abh.*, 182, 11–14

Juangodoyite occurs as a fine-grain pseudomorph after chalconatronite [Na₂Cu(CO₃)₂·3H₂O], with crystallites up to 5 μm in size. The mineral is a bright ultramarine color with a blue streak, has an earthy luster, and shows no fluorescence. It is easily dissolved in hydrochloric acid with strong effervescence. It is not soluble in water but will hydrate to chalconatronite within hours. Mohs hardness and other physical and optical properties could not be determined due to the minute grain size of the material, but it is referred as being soft. Electron microprobe analyses of Juangodoyite (16 analyses) gave Na₂O 28.27, CuO 33.77, CO₂ 38.45, sum 100.49 wt%, corresponding to Na_{2.08}Cu_{0.98}(C_{1.99}O₆) based on the sum of 6 anions. The ideal formula is Na₂Cu(CO₃)₂. The refractive index calculated with the Gladstone-Dale relationship between the empirical formula and calculated density gives 1.571.

Single-crystal studies were impossible due to the small crystal size. Juangodoyite is monoclinic, *P*2₁/*a*, with refined unit-cell parameters from the powder diffraction pattern and Rietveld refinement (*R*_p = 0.0470, *R*_w = 0.0617, *S* = 1.55, *R*_{bragg} = 0.0825), *a* = 6.171(4), *b* = 8.171(5), *c* = 5.645(4) Å, β = 116.23(2)°, *V* = 255.33(15) Å³, *Z* = 2, *D*_{calc} = 2.984 g/cm³. The strongest lines on the X-ray diffraction pattern (Philips X'pert powder diffractometer, CuKα radiation, 46 lines) include 5.056(66,001), 4.575(57,110), 4.298(37,011), 4.258(75,11 $\bar{1}$), 3.284(18,120), 2.907(32,111), 2.666(100,11 $\bar{2}$), 2.619(65,210), 2.450(33,2 $\bar{2}$ 1), 2.390(25,13 $\bar{1}$), 1.893(16,041), 1.799(16,310). Juangodoyite is identical to the synthetic compound, sodium bis(carbonato) cuprate(II) and represents a new mineral structure type.

The mineral was discovered in the oxidation zone of the Santa Rosa mine in the Atacama desert in northern Chile, near the city of Iquique. The deposit is a polymetallic vein that was mined for silver, copper, and lead minerals. Juangodoyite is associated with chalconatronite, malachite, calcite, anhydrite, trona, nahcolite, and two other unknown minerals. The mineral is named for Juan Godoy, who discovered the Chañarcillo silver mine in 1832. The type material has been deposited at the Mineralogical Museum of the University of Hamburg, Germany (no catalog number included). **R.R.**

OXYKINOSHITALITE*

L.N. Kogarko, Y.A. Uvarova, E. Sokolova, F.C. Hawthorne, L. Ottolini, J.D. Grice (2005) Oxykinoshitalite, a new species of

mica from Fernando de Noronha Island, Pernambuco, Brazil: occurrence and crystal structure. *Can. Mineral.*, 43, 1501–1510.

Oxykinoshitalite, the oxy-analog of kinoshitalite is brittle, $H = 2\frac{1}{2}$, bright orange to brown in color, with a brown streak, vitreous luster, perfect {001} cleavage, and a splintery fracture. The mineral is strongly pleochroic, with X pale brown, $Y \approx Z$ deep red-brown, $X \wedge c = 2^\circ$ (in β obtuse), $Y = b$, $Z \wedge a = 8^\circ$ (in β obtuse) with absorption $X < Y \approx Z$. It is biaxial positive, α 1.708(1), β 1.710(1), γ 1.719(1), $2V_{\text{obs}} 56(2)^\circ$, $2V_{\text{calc}} 51^\circ$. The mean of electron microprobe analyses and ion microprobe analyses (for H, Li, and B) of the crystal studied by X-ray structure refinement is SiO₂ 26.96, TiO₂ 11.63, Al₂O₃ 15.48, Fe₂O₃ 0.90, FeO 11.37, MnO 0.12, MgO 10.58, BaO 13.91, CaO 0.15, K₂O 3.84, Na₂O 0.41, H₂O 0.55, F 0.92, Cl 0.06, Li 0.017, B 0.0021, O = F –0.39, O = Cl –0.01, sum 96.49 wt%, corresponding to (Ba_{0.48}K_{0.43}Na_{0.07}Ca_{0.01})_{Σ0.99}(Mg_{1.38}Fe_{0.83}Ti_{0.77}Fe_{0.02}Mn_{0.01})_{Σ3.00}(Si_{2.36}Al_{1.60}Fe_{0.04})_{Σ4.00}O₁₀[O_{1.42}(OH)_{0.32}F_{0.26}]_{Σ2.00} on the basis of (O + OH + F) = 12 apfu and neglecting Cl, Li, and B, with Fe³⁺/ΣFe calculated for electroneutrality, ideally Ba(Mg₂Ti)(Si₂Al₂O₁₀(O₂). Single-crystal X-ray structure study ($R = 0.0427$) showed the mineral to be the 1M polytype and a trioctahedral member of the brittle mica subgroup of the mica group: monoclinic, space group $C2/m$, $a = 5.3516(7)$, $b = 9.2817(11)$, $c = 10.0475(13)$ Å, $\beta = 100.337(3)^\circ$, $V = 490.98(18)$ Å³. Powder diffraction data were collected with a Gandolfi camera (114.6 mm, $\lambda = 1.54178$ Å) and yielded refined unit-cell parameters $a = 5.350(11)$, $b = 9.273(13)$, $c = 10.049(12)$ Å, $\beta = 100.084(14)^\circ$, $V = 490.8(9)$ Å³, and the strongest lines [d_{meas} in Å (I, hkl): 3.646 (70, $\bar{1}12$), 3.383 (60,002), 3.130 (70,112), 2.902 (50, $\bar{1}13$), 2.637 (100, $\bar{1}31$), 2.435 (50,201), 2.172 (90, $\bar{1}33$), 1.988 (50,133), 1.661 (50, $\bar{1}35$), 1.547 (50,312). $D_{\text{obs}} = 3.3(1)$ g/cm³ (determinative method unspecified), $D_{\text{calc}} = 3.45$ for the empirical formula and 3.63 g/cm³ for the ideal formula with $Z = 2$. The most closely related species are anandite Ba(Fe²⁺)(Si₃Fe³⁺)O₁₀[S(OH)], chernykhite Ba(V₂)(Si₂Al₂)O₁₀(OH)₂, ferrokinoshitalite Ba(Fe²⁺)(Si₂Al₂)O₁₀(OH)₂, ganterite [Ba_{0.5}(Na,K)_{0.5}](Al₂)(Si_{2.5}Al_{1.5})O₁₀(OH)₂, and kinoshitalite Ba(Mg₃)(Si₂Al₂)O₁₀(OH)₂.

Oxykinoshitalite occurs in an olivine nephelinite with olivine, clinopyroxene, Fe–Ti oxide, nepheline, calcite, apatite, and K-rich feldspar on Fernando de Noronha Island, Pernambuco, Brazil. This olivine nephelinite belongs to the Quixaba Formation, which is dominated by nepheline basalt flows with minor nephelinite dykes, tuffs, and breccias. The mineral is named in accord with the IMA-approved nomenclature for minerals of the mica group (Rieder et al. 1998, *Can. Mineral.*, 36, 905–912). The mineral corresponds to IMA mineral no. 2004–013. Type material is deposited in the Canadian Museum of Nature, Ottawa.

Discussion. The site populations of the empirical formulae reported in the abstract do not agree with those given in the text and tables; data from the tables are given here. The ideal formula given does not correspond with an end-member formula, but is stated to be a pragmatic choice given the situation of multiple coupled substitutions in the mineral **A.J.L.**

POTASSIUM ANALOG OF KENTBROOKSITE

R.K. Rastsvetayeva, K.A. Rosenberg, A.P. Khomyakov (2005) Crystal structure of the K analog of kentbrooksit. *Dokl. Akad. Nauk*, 403, 636–639 (in Russian).

A rare, potassium-rich eudialyte-group mineral has been found from an alkaline pegmatite in the vicinity of Mt. Koashva in the Khibiny Massif, Kola Peninsula, Russia. It forms pale yellow, porcelaneous rims about cherry-red eudialyte, is uniaxial negative with a mean refractive index of 1.620, and has a density of 2.93 (meas) or 3.01 g/cm³ (calc). The composition of the mineral, as determined by electron microprobe and wet-chemical analysis (H₂O and CO₂), and based on 29(Si, Zr, Ti, Nb, Hf) is: Na_{12.2-12.7}K_{1.2-1.45}Ca_{5.8-6.0}Sr_{0.75-0.95}Ba_{0.04}Fe_{0.9-1.1}Mn_{1.8}(Ce, La, Nd)_{0.6-0.7}Y_{0.1}Al_{0.01-0.02}Si_{25.3-25.4}Ti_{0.05-0.1}Zr_{2.95}Hf_{0.06}Nb_{0.68}Cl_{0.18-0.29}·2.7H₂O·0.42CO₂. Single-crystal X-ray structure refinement gives a 14.281(4), c 30.243(7) Å, space group $R3m$, R_{aniso} 0.038 [1060 observed, independent reflections, $F > 3\sigma(F)$], and indicates that the ideal formula is Na₁₂(K, Sr, Ce)₃Ca₆Mn₃Zr₃NbSi₃[Si₃O₉]₂[Si₉O₂₇]₂(O, OH)₄(H₂O, CO₃, Cl)₂ ($Z = 3$). The mineral would seem to be the potassium analog of kentbrooksit, and has the usual features of the eudialyte structure; however, unlike kentbrooksit (Na), it has K dominant at the 11-coordinated A4 site [“N4” by the nomenclature of Johnsen et al. (2003)]. **T.S.E.**

NA_{1.265}MN_{2.690}MN_{0.785}(PO₄)₃

O.V. Yakubovich, W. Massa, P.G. Gavrilenko, O.V. Dimitrova (2005) The crystal structure of a new synthetic member in the wylieite group: Na_{1.265}Mn_{2.690}Mn_{0.785}(PO₄)₃. *Eur. J. Mineral.*, 17, 741–747.

A potentially new member of the wylieite group has been hydrothermally synthesized at 400 °C, 10 MPa over a duration of 20 days using a mixture of Mn₂O₃, NaH₂PO₄, and NaCl in a weight ratio of 1:1:1. The resultant crystals are dark cherry-red. Chemical analyses (average of five analyses) gave Na₂O 6.76, MnO 34.18, Mn₂O₃ 16.53, P₂O₅ 42.66, total 100.13 wt%, corresponding to Na_{1.09}Mn_{2.39}Mn_{1.04}(PO₄)₃ on the basis of (PO₄)₃. No physical or optical data was given.

The crystal structure of the synthetic product (0.14 × 0.08 × 0.04 mm crystal) was solved by direct methods and refined against F^2 data to $R = 0.0277$ for 1723 reflections with $I > 2\sigma(I)$. It is monoclinic, $P2_1/c$, $a = 6.529(6)$, $b = 12.653(1)$, $c = 10.952(1)$ Å, $\beta = 97.18(1)^\circ$, $V = 897.68(11)$ Å³, $Z = 4$, $D_{\text{calc}} = 3.736$ g/cm³. The crystal structure is based on a cationic framework of edge-sharing Mn octahedra with PO₄ tetrahedra which strengthen the framework by shared-vertices. Sodium atoms occupy the interstices and channels parallel to a . It differs from other members of the wylieite group by the fact that it contains Mn³⁺ in the position usually occupied by either Al or Fe³⁺. **P.C.P.**

SIMFERITE* AND UNKNOWN PHOSPHATE MINERAL

V.V. Bayrakov, O.V. Yakubovich, M.A. Simonov, S.E. Borisovskiy, T.A. Ziborova (2005) Simferite Li(Mg, Fe³⁺, Mn³⁺)₂[PO₄]₂, a new mineral. *Mineral. Zh.*, 27(2), 112–120 (in Russian, English abstract).

The “new” mineral species simferite (IMA 89-16) was discovered in drill core that intersected a granitic pegmatite of the albite-spodumene class, taken about 25 km from Berdyansk in the southeastern Zaporizhzhya (Zaporozh’ye) Region, Ukraine. The pegmatite lies among mafic-ultramafic rocks that experienced regional metamorphic grades of greenschist to amphibolite facies. Contact metasomatism converted some of these amphibolites

(tremolites) to a narrow (<20 cm thick), nearly monomineralic phlogopite selvage along the hanging-wall contact of the pegmatite, and locally enriched the pegmatite melt in Mg, Fe, and Mn. Simferite formed as a result of this enrichment, and occurs within a near-contact albite-oligoclase zone, less than 5 cm from the contact with the phlogopite selvage. Although the direct mineralogical associates of simferite are not described, the general mineralogy of the albite-oligoclase zone is quartz, oligoclase, albite, and muscovite, with small quantities of phlogopite, tourmaline, apatite, diopside, "hortonolite," tantalum-niobium oxides, ilmenite, and löllingite. Simferite physically resembles almandine-andradite, occurring as dark red to nearly black, somewhat isometric grains to 3 mm in size. It is more rarely found as crystals to 0.1 mm bound by {001}, {010}, {110}, and poorly expressed {120} faces. Streak cinnamon brown, glassy to greasy luster. The prominent cleavage direction is {010}, with poor {100}. Fracture is uneven and rough to conchoidal. The mineral shows negative elongation, and straight extinction with respect to cleavage traces that mutually intersect at 87–90°. The optic plane is (100); the orientation matrix is $a = Y$, $b = Z$, $c = X$. Intense pleochroism: Z yellow to reddish yellow, Y brownish yellow to brown, X light brown to brownish red. Absorption is $X > Y > Z$. Dispersion of the optic axial angle is strong, $r > v$. Compositional variability is manifested in variable optical and physical properties: $\alpha = 1.690$ – 1.704 , $\beta = 1.702$ – 1.716 , $\gamma = 1.712$ – 1.726 , and $2V = -54$ to -60° (white light); $D_{\text{meas}} = 3.22$ to 3.27 g/cm³ and $D_{\text{calc}} = 3.25$ g/cm³. Twinning is widespread, most commonly as simple interpenetration twins. The optical Z axes of each twin member coincide, whereas the angle between the other pairs of X and Y axes is 10°. Microindentation hardness is 457 kg/mm². Single-crystal diffractometry gave $a = 4.7468(7)$, $b = 10.101(2)$, $c = 5.8992(7)$ Å, space group $Pbnm$ or $Pbn2_1$, $Z = 2$. The strongest lines in the Debye powder pattern are (d Å, $I\%$; hkl): (4.30, 90; 110), (3.45, 60; 120), (2.93, 80; 002), (2.48, 100; 131), (2.42, 60; 112), (2.23, 60; 140), (1.01, 60; unindexed). The composition of the mineral, by electron microprobe, is Li₂O 5.45–5.35, MgO 15.78–12.36, Fe₂O₃ 16.87–17.39, Mn₂O₃ 9.84–14.83, CaO undetected to 0.08, P₂O₅ 51.90–51.00, total 99.84–101.01 wt%, with Li₂O calculated assuming 1 Li atom per formula unit (Li₂O was also measured by an undisclosed method as 6.12 wt%). The average composition of the mineral is Li(Mg_{1.0}Fe³⁺_{0.6}Mn³⁺_{0.4})_{Σ2}[PO₄]₂, calculated on a basis of 3 cations per formula unit. Microprobe and infrared spectroscopic data indicate some degree of replacement of simferite by a phosphate mineral enriched in Ca and H₂O (perhaps collinsite). The mineral is structurally and compositionally related to triphylite, heterosite, purpurite, and other minerals. The authors state that the name simferite is derived from the Greek for "hospitable," in allusion to the fact that four (non-P) cations enter its structure. Original (type?) samples of the mineral have been deposited with the A.E. Fersman Museum, Moscow, Russia.

Discussion—unknown mineral. Type simferite would seem to occur as a replacement of another, unknown primary phosphate mineral, relicts of which have the following optical properties: colorless, two directions of cleavage at 90°, $\alpha = 1.641$, $\beta = 1.647$, $\gamma = 1.648$, $\gamma - \alpha = 0.007$, $2V = +81$ to $+83^\circ$. **T.S.E.**

STAVELOTITE-(La)*

H.-J. Bernhardt, T. Armbruster, A.-M. Fransolet, W. Schreyer (2005) Stavelotite-(La), a new lanthanum-manganese-sorosilicate mineral from the Stavelot Massif, Belgium. *Eur. J. Mineral.*, 17, 703–714.

Stavelotite-(La) is a minor accessory mineral in a quartz vein in the Stavelot Massif at Le Coreux, 1 km north of Salmchâteau along the western flanks of the Salm river valley. The mineral is black, opaque, with a metallic luster, no cleavage or fracture, and hardness was not determined. In transmitted light, it is a dark reddish brown color. Stavelotite-(La) occurs as rounded to rectangular, equidimensional masses 10–160 μm in diameter consisting of anhedral single crystals or two or more untwinned individual crystals. In reflected light, stavelotite-(La) is gray and shows very weak to weak bireflectance, and very weak pleochroism. Under cross-polarized light, it shows very weak anisotropism and complete extinction. Brown, weak internal reflections are only visible in oil. Reflectance percentages for R_{min} and R_{max} in air (and in oil) are 13.6, 14.4 (3.0, 3.7) (470 nm), 13.2, 13.9 (2.9, 3.5) (546 nm), 13.0, 13.7 (2.8, 3.4) (589 nm), 12.8, 13.4 (2.7, 3.2) (650 nm), respectively.

Electron microprobe analyses (WDS, average of 65 analyses) gave SiO₂ 20.17, TiO₂ 0.44, MnO₂ 4.83, Mn₂O₃ 31.67, MnO 5.99, Al₂O₃ 3.30, Fe₂O₃ 13.08, Sc₂O₃ 1.47, La₂O₃ 8.39, Nd₂O₃ 3.39, Ce₂O₃ 0.44, CaO 0.33, MgO 1.06, CuO 2.11, CoO 0.18, sum 96.86 wt.%, corresponding to the empirical formula (La_{1.828}Nd_{0.715}Ce_{0.095}Ca_{0.209}Sc_{0.153})_{Σ3.00}Mn_{2.998}(Cu_{0.941}Mn³⁺_{0.058})_{Σ0.999}(Mn³⁺_{14.183}Fe³⁺_{3.814}Al_{2.298}Mn⁴⁺_{1.973}Mg_{0.933}Sc_{0.604}Ti_{0.195}Co_{0.085})_{Σ26.085}Si_{11.915}O₇₂ (based on 45 cations and 72 O atoms). The ideal formula for stavelotite-(La) is La₃Mn₂₃Cu²⁺(Mn³⁺,Fe³⁺,Mn⁴⁺)₂₆[Si₂O₇]₆O₃₀.

The crystal structure of stavelotite-(La) was solved by direct methods and refined on a single crystal 100 × 100 × 30 μm in size which was drilled out of a thin section, $R_1 = 0.100$ for 2839 reflections with $F_o > 4\sigma(F_o)$. Stavelotite-(La) is trigonal, space group $P3_1$, with $a = 11.525(2)$, $c = 33.347(9)$ Å, $V = 3836$ Å³, $Z = 3$, $D_{\text{calc}} = 4.489$ g/cm³. The strongest lines in the powder pattern are (Debye-Scherrer camera, CuKα1 radiation, 57 lines given) include (d Å, $I\%$, hkl): 11.116(18,003), 5.446(31,112), 3.1873(19,033,303), 2.7789(40,0.0.12), 2.7232(100,224), 2.3702(29,228), 1.6887(28,2.2.16), and 1.6635(40,600). Stavelotite-(La) is a sorosilicate with a densely packed complex crystal structure that is related to the lāngbanite structure type [Moore et al. (1991), *Am. Mineral.*, 76, 1408–1425]. It consists of four different polyhedral layers stacked parallel to c : (1) eight-coordinated distorted Mn²⁺ which share edges with strongly distorted Mn³⁺ tetragonal bipyramids with one square planar site for Cu²⁺; (2) regular Mn³⁺ and Mn⁴⁺ octahedra with unidirectional SiO₄ tetrahedra; (3) edge-sharing SiO₄ tetrahedra oriented in two opposing directions connecting layers 2 and 4, forming Si₂O₇ groups, as well as [8]-coordinated La; and (4) similar to layer 2 but with inverted SiO₄ tetrahedra.

Stavelotite-(La) occurs as a late-stage, minor accessory phase in a late quartz vein cross-cutting deep purple, highly oxidized manganiferous Ordovician phyllites at Le Coreux, 1 km north of Salmchâteau, Belgium. It is associated with albite, braunite, hematite, hollandite-strontiomelane, kanonaite, Mn-oxides, and

muscovite. The name is for the Stavelot Massif in the Belgian Ardennes Mountains, and Stavelot, which is a historical town in eastern Belgium (IMA no. 2004-014). Type material has been deposited at the Mineralogical Collection of the Institut für Geologie, Mineralogie und Geophysik, Ruhr-Universität Bochum, Germany (catalog no. 25169). **P.C.P.**

UNGAVAITE*

A.J. McDonald, L.J. Cabri, C.J. Stanley, N.S. Rudashevsky, G. Poirier, J.E. Mungall, K.C. Ross, B.R. Denham, V.N. Rudashevsky (2005) Ungavaite, Pd₄Sb₃, a new intermetallic mineral species from the Mesamax Northwest deposit, Ungava region, Quebec, Canada: description and genetic implications. *Can. Mineral.*, 43, 1735–1744.

Ungavaite occurs as grains from 36 to 116 μm in diameter in heavy-mineral concentrates derived from drill-core rejects. The mineral is somewhat malleable, hardness not given, opaque, dark gray with undetermined streak, and metallic luster. Cleavage appears absent, and fracture was not observed. In plane-polarized reflected light ungavaite is bright creamy white with no internal reflections. The mineral shows weak birefractance, no pleochroism, and weak anisotropy, with rotation tints that are pale blue-gray to deep blue. Reflectance values of ungavaite (in air, Zeiss 314 WTiC standard) are (R₁–R₂) 50.2–50.5 (470 nm), 55.6–55.9 (546 nm), 57.9–58.3 (589 nm), and 60.2–60.7 (650 nm). The average of 16 electron microprobe analyses of a single grain (range) gave: As 0.20 (0.17–0.26), Fe 0.13 (0.05–0.31), Te 0.09 (0.03–0.14), Sb 44.59 (43.32–44.95), Bi 0.42 (0.34–0.48), Hg 0.19 (0.09–0.35), Pd 54.53 (53.31–54.98), sum 100.15 wt%, corresponding to Pd_{4.043}(Sb_{2.889}As_{0.021}Fe_{0.018}Bi_{0.016}Hg_{0.007}Te_{0.006})Σ_{2.957} on the basis of seven atoms, ideally Pd₄Sb₃. Analysis of a second grain gave very similar results. Ungavaite is considered to be isostructural with genkinite (Pt,Pd)₄Sb₃, on the basis of similarities between their powder patterns and stoichiometries: tetragonal, possible space groups *P*₄₁₂₁, *P*₄₁₂₂, *P*₄₃₂₁, *P*₄₂₁₂, or *P*₄₂₂₂. Powder diffraction data were collected with a Gandolfi camera (114.6 mm, λ = 1.7902 Å) and yielded refined unit-cell parameters *a* = 7.7388(4), *c* = 24.145(1) Å, *V* = 1446.02(1) Å³, and the strongest lines [*d*_{meas} in Å (1, *hkl*): 3.008 (90,008), 2.263 (100,134), 2.147 (30,230), 1.9404 (60,400), 1.6337 (20,245), 1.2492 (20,2.1.18), 1.2465 (20,614), 1.2043 (30,2.2.18), 1.2002 (30,624), 1.1705 (15,5.2.12). *D*_{calc} = 7.264(1) for the empirical formula, 7.258 g/cm³ for the ideal formula and *Z* = 8. The most closely related species is genkinite (Pt,Pd)₄Sb₃.

Ungavaite occurs as rare anhedral grains with inclusions of Au–Ag alloy or with attached chalcopyrite and a chlorite-group mineral. It is associated with chalcopyrite, a chlorite-group mineral, cobaltite, galena, magnetite, pentlandite, monoclinic pyrrhotite, and sphalerite. Associated precious-metal minerals include altaite, Au–Ag alloy, hessite, michenerite, naldrettite, petzite, sperrylite, and sudburyite. Ungavaite was discovered in concentrates from drill-core rejects (MXNW 02–50) from the Mesamax Northwest Ni–Cu–Co–PGE deposit (61°34'25" N and 73°15'36" W), located in the Cape Smith fold belt of the Ungava region, northern Quebec, Canada. The mineral is named for the Ungava region, in which it was discovered. Type material is deposited in the Natural History Museum, Cromwell Road,

London, U.K. (polished section; catalog number BM 2004, 34) and the Canadian Museum of Nature, Ottawa (polished section; catalog number CNMMN 84397). **A.J.L.**

UNNAMED DIMORPH OF FUKALITE

R.K. Rastsvetaeva, N.B. Bolotina, A.E. Zadov, N.V. Chukanov (2005) Crystal structure of fukalite dimorph Ca₄[Si₂O₆](CO₃)(OH)₂ from the Gumeshevsk deposit, Urals. *Dokl. Akad. Nauk*, 405, 524–528 (in Russian); *Dokl. Earth Sci.*, 405A, 1347–1351 (in English).

An apparently new dimorph of fukalite has been found in hydroxyllestadite skarn at the Gumeshevsk porphyry copper–copper skarn deposit, central Ural Mountains, Sverdlovsk Region, Russia. It occurs as colorless, slender prismatic to acicular crystals to 0.3 mm long, and has perfect {100} cleavage. It is similar to fukalite in terms of X-ray diffraction data (with a cell corresponding to *b*_{fukalite} × 2*a*_{fukalite} × *c*_{fukalite}) and is nearly identical in chemical composition (but lacks subordinate F found in fukalite). Electron microprobe analysis and IR spectroscopy indicate the chemical formula Ca₄[Si₂O₆](CO₃)(OH)₂. Single-crystal X-ray structure refinement [MoKα, 1272 independent reflections with *F* > 3σ(*F*)] gave *a* = 3.786(1), *b* = 10.916(2), *c* = 23.379(6), space group *P*₂₁₂₁, *Z* = 4, *D*_{calc} = 2.78 g/cm³. The crystal structure was solved by direct methods and difference Fourier techniques to *R*_{anis.} = 0.063. The structure refinement detected 4 Ca positions, 4 half-occupied Si positions, 1 C position, 8 O positions, 2 half-occupied O positions, 2 (OH) positions and 2 H positions. The Ca–O polyhedra are [6]- and [7]-coordinated. Ca1 and Ca4 are coordinated by bifurcated octahedra (6 O + 1 OH). Statistically, half of Ca2 and Ca3 are coordinated by capped octahedra (5 O + 2 OH); the other half, octahedra (4 O + 2 OH). The Ca–O polyhedra share edges and show strong columnar characteristics despite whether the columns are cross-linked to form weak, corrugated layers hosting the bifurcated octahedra or strong, corrugated, tilleyite-like layers hosting the capped octahedra/octahedra. The SiO₄ tetrahedra of the structure are corner-linked to form batisite-like single chains along *a*. The model has two statistical distributions of chains, each half-occupied over the whole of the crystal. The silicate chains serve to cross-link the Ca–O layers, passing through hexagonal channels in the layers; carbonate groups serve to reinforce linkages between the layers. The mineral belongs to the C–S–H class of compounds, a major component of Portland cement. The authors state that although the crystal structure of fukalite is unknown, they believe that their mineral is its dimorph based on structural limitations associated with (the currently accepted) fukalite cell with *a*_{fukalite} = *b*/*2*_{dimorph}.

Discussion. It would seem that the taxonomic concepts presented in this paper have not yet been submitted to the IMA. **T.S.E.**

NEW DATA

ASPIDOLITE

Y. Banno, R. Miyawaki, T. Kogure, S. Matsubara, T. Kamiya, S. Yamada (2005) Aspidolite, the Na analog of phlogopite, from Kasuga-mura, Gifu Prefecture, central Japan: description and structural data. *Mineral. Mag.*, 69, 1047–1057.

Aspidolite, the Na analog of phlogopite, occurs as light brown crystals interleaved with and rimmed by phlogopite plates from 0.1 to 1.2 mm long. It has a white streak, a perfect (001) cleavage, is elastic, and has an estimated Mohs hardness of 2–3. It is optically biaxial negative with positive elongation and $Z \parallel$ cleavage. It is pleochroic with $X =$ colorless to yellow, $Y = Z =$ pale yellowish brown.

Electron microprobe analyses of aspidolite gave (representative analysis) SiO_2 37.0, TiO_2 0.96, Al_2O_3 22.7, FeO 4.12, MgO 22.1, CaO 0.04, Na_2O 6.79, K_2O 0.97, F 0.16, $\text{H}_2\text{O}_{\text{calc}}$ 4.26, sum 99.0 wt.%, corresponding to $(\text{Na}_{0.96}\text{K}_{0.10})_{\Sigma 1.06}(\text{Mg}_{2.27}\text{Al}_{0.41}\text{Fe}_{0.23}^{2+}\text{Ti}_{0.05})_{\Sigma 2.96}(\text{Si}_{2.56}\text{Al}_{1.44})_{\Sigma 4.00}\text{O}_{10}(\text{OH}_{1.97}\text{F}_{0.03})_{\Sigma 2.00}$ based on 11 O (Fe was expressed solely as Fe^{2+}).

Aspidolite at Kasuga-mura occurs as both aspidolite-1A and aspidolite-1M. The unit-cell parameters for both polytypes were refined from X-ray powder diffraction data (Gandolfi camera, 114.6 mm, $\text{CuK}\alpha$ radiation). Aspidolite-1A is triclinic, $\bar{C}1$, with $a = 5.289(6)$, $b = 9.16(1)$, $c = 9.892(9)$ Å, $\alpha = 94.45(9)$, $\beta = 97.74(9)$, $\gamma = 90.0(1)^\circ$, $V = 473.4(9)$ Å³. Aspidolite-1M is monoclinic, $a = 5.291(8)$, $b = 9.16(2)$, $c = 10.12(2)$ Å, $\beta = 105.1(1)^\circ$, $V = 473(1)$ Å³. The X-ray powder diffractogram obtained for the sample represents a mixture of aspidolite-1A, aspidolite-1M, phlogopite-1A, and phlogopite-1M. The pattern was indexed based on calculated patterns for phlogopite and assumed crystal models of aspidolite-1A and aspidolite-1M (Kogure et al. 2004, *Eur. J. Mineral.*, 16, 891–897). The strongest lines for aspidolite-1A (22 lines given) include 9.73(80,100), 4.57(40,020, $\bar{1}$ 10,110), 3.26(40,003), 2.62(100, $\bar{2}$ 01,13 $\bar{1}$,130,200), 2.55(30,023, $\bar{1}$ 31,1 $\bar{3}$,1 $\bar{3}$ 1), and 2.45(20,13 $\bar{2}$,201). The strongest lines for aspidolite-1M (17 lines given) include 9.77(100,001), 4.59(25,020), 4.46(15,110), 3.74(15, $\bar{1}$ 12), 3.33(15,022), 3.26(50,003), 2.97(15, $\bar{1}$ 13,112), 2.61(100, $\bar{1}$ 31, $\bar{1}$ 30), 2.55(25, $\bar{2}$ 02,200), 2.45(20, $\bar{1}$ 32), 2.19(20, $\bar{1}$ 33,132), and 2.05(15, $\bar{2}$ 04,202). The crystal structure of aspidolite was investigated by high-resolution TEM by Kogure et al. (2004, *Eur. J. Mineral.*, 16, 891–897).

Aspidolite is the Na analog of phlogopite. It was found in waste rock in the Kawai pit of the Kasuga mine. The rock represents Zone 4 (forsterite-diopside) of the contact aureole around the Kaizuki-yama granite (>3 km wide) which ranges in metamorphic grade from greenschist to amphibolite facies. The thermally metamorphosed rocks were Jurassic shale, sandstone, and chert with mafic volcanics, dolostone, and limestone. The sample from which the aspidolite was taken comprised of phlogopite, amphibole (pargasite and magnesiosadanagaite), titanite, calcite, scapolite, apatite, pyrrhotite, and chalcopyrite, with minor chlorite and pyrite. Although aspidolite has been known for more than a century and the name formally assigned to replace sodium phlogopite in 1998 by the IMA, this manuscript represents the first formal description of type aspidolite (IMA no. 2004-049). Type specimens have been deposited at the Geological Museum, Geological Survey of Japan, AIST, Tsukuba (catalog no. GSI M35151-4) and at the National Science Museum, Tokyo, Japan (catalog no. NSM-28719). **P.C.P.**

CUMENGÉITE

G. Cruciani, P. Orlandi, M. Pasero, and M. Russo (2005) First Italian occurrence of cumengéite from Vesuvius: crystal-structure refinement and revision of the chemical formula. *Mineral. Mag.*, 69, 1037–1045.

Cumengéite has been found among minerals of exhalative origin associated with the 1944 fumarolic activity at Mount Vesuvius. It forms adamantine, transparent, indigo-blue cubo-octahedral crystals to 0.1 mm associated with tenorite, gypsum, and cotunnite. Structure analysis gives a 15.1007(2), c 24.4940(4), space group $I4/mmm$, R_{obs} 0.036 [$3462 F > 4\sigma(F)$ reflections], wR 0.088 (all 4177 refl.), S 1.21. The structural model is similar to that of Hawthorne and Groat (1986), with the exception being that 6 H_2O molecules per formula unit were detected. As a result of this discrepancy, the authors studied the structure of a fragment of holotype cumengéite; the O atoms of the H_2O groups were also located in this structure refinement (R_{obs} 0.039, wR 0.124, S 1.049). The correct formula of cumengéite is $\text{Cu}_{20}\text{Pb}_{21}\text{Cl}_{42}(\text{OH})_{40}\cdot 6\text{H}_2\text{O}$. The H_2O molecule centered at O5 is linked to Cu2 in a trans-configuration with respect to the Cl atom in the coordination sphere of Cu2, completing the [6]-coordination of Cu2. The second H_2O molecule, centered at O6, coordinates Pb2, changing its coordination polyhedron to a mono-capped square antiprism. **T.S.E.**

ISOKITE

R. Hochleitner, K.T. Fehr (2005) Isokite, $\text{CaMg}[\text{FlPO}_4]$, from Senhora de Assunção, Portugal: new find and new data. *Neues Jahrb. Mineral. Abh.*, 182, 103–108.

Isokite, $\text{CaMg}(\text{PO})_4\text{F}$, has been found from boulders in the Senhora de Assunção quarry, at Aldeia Nova, Satao, Portugal. The occurrence consists of a granitic pegmatite of the beryl-columbite-phosphate subtype. The isokite is fine-grained and massive and, with chlorite, replaces primary triplite (masses to 30 cm diameter) and manganoan fluorapatite. The isokite-chlorite assemblage would seem to be genetically related to late Ca-Mg-enriched hydrothermal fluids of possible external origin to the pegmatite. X-ray powder diffraction data and chemical compositional data for isokite from this locality are comparable to type isokite. The study presents new IR absorption spectral data for the mineral. All observed bands in the spectrum (400 to 4000 cm^{-1}) are assigned to vibrational modes for the PO_4 group; other lattice modes were not observed (i.e., all $<400 \text{ cm}^{-1}$).

Discussion. The authors incorrectly assign the pegmatite to the NYF family; it actually is a member of the LCT family of Černý (1991, *Geoscience Can.*, 18, 49–67). **T.S.E.**

RANKACHITE

K. Walenta, T. Theye (2005) Iron-poor rankachite from the Clara mine. *Der Erzgräber*, 19, 58–62 (in German with English abstract).

An Fe-poor variety of rankachite is described from the Clara mine, Central Black Forest, Germany. The mineral occurs as small brown-black pustules, with a diameter of 0.6 mm and composed of radially intergrown acicular to lath-like crystals up to a length of about 0.1 mm. It is associated with fluorite, quartz, barite, an earlier described variety of ferritungstite and pyrite. Electron microprobe analyses gave (average of three analyses; beam size not indicated): CaO 4.24, FeO 0.48, V_2O_5 12.95, WO_3 72.66, H_2O 9.67 (by difference), sum 100.00 wt%, corresponding to the empirical formula $\text{Ca}_{0.95}\text{Fe}_{0.08}\text{V}_{1.78}\text{W}_{3.93}\text{H}_{13.45}\text{O}_{24}$, on the basis of 24 O atoms. This formula contains considerably

less iron than that of the type material ($\text{Ca}_{0.63}\text{Fe}_{0.56}\text{V}_{1.96}\text{W}_{3.89}\text{H}_{12.52}\text{O}_{24}$). An idealized formula $\text{CaO}\cdot\text{V}_2\text{O}_5\cdot 4\text{WO}_3\cdot 6\text{H}_2\text{O}$ is suggested. A re-interpretation of the X-ray powder diffraction data of type rankachite suggests a monoclinic unit-cell (possible space groups $P2_1$ and $P2_1/m$) with $a = 10.62$, $b = 8.16$, $c = 5.50$ Å, $\beta = 98^\circ$, and $V = 471.99$ Å³ ($D_x = 4.46$ g/cm³) for the type material and $a = 10.73$, $b = 8.18$, $c = 5.50$ Å, $\beta = 97^\circ$, and $V = 479.14$ Å³ ($D_x = 4.34$ g/cm³) for the Fe-poor variety ($Z = 1$). The increased unit-cell parameters of the Fe-poor variety are explained by higher Ca and lower Fe contents. Optical properties: $\alpha = 1.735(5)$, straight extinction, anomalous blue-green interference colors. The crystals are elongate along [001] and flattened on either {100} or {010}. Strong lines (weak ones not given) of the indexed powder pattern of the Fe-poor variety (57.3 mm camera, FeK α radiation, intensities visually estimated): 10.69 (10) 100; 5.46 (9) 001; 4.09

(8) 020, $\bar{2}01$; 3.56 (9) 300; 3.27 (8) 021, 310; 3.07 (8) 121; 2.68 (8) 320, 311; 1.927 (7) 032, $\bar{1}32$. A re-indexed powder pattern of type rankachite is also given; strongest lines are: 10.64 (10) 100; 5.44 (7) 001; 4.57 (6) 101; 4.35 (5) $\bar{1}11$; 4.08 (6) 020, $\bar{2}01$; 3.51 (6) 300; 3.26 (6) 021, 211; 3.04 (6) 121; 2.63 (6) 130, 400, 311; 1.920 (5) 032.

Discussion. The authors do not mention an earlier brief comment on a successful crystal-structure solution of rankachite, proof of its monoclinic symmetry, the tetravalent character of the V, and a layer structure with intercalated Ca²⁺ ions and water molecules [U. Kolitsch, G. Göttinger (2000) Einige Neufunde aus der Grube Clara im mittleren Schwarzwald: Eulytin, Namibit, Volborthit, Gearksutit, Spertiniit, Monazit-(La), Protasit, Sainfeldit, Cyanotrichit und Vauquelinit. *Der Erzgräber*, 14, 33–47 (in German).] **U.K.**