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New Mineral Names*,†

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This New Mineral Names has entries for 18 new minerals, including aluminopyracmonite, bobmeyerite, hylbrownite, kihlmanite-(Ce), kleberite, leydetite, nestolaite, paratakamite-(Mg), paratacamite-(Ni), schlüterite-(Y), švenekite, tangdanite, vanadoallanite-(La), and pyrochlore supergroup species fluorcalciomicrolite, fluorcalcioroméite, hydroxycalciopyrochlore, oxycalcioroméite, and oxyplumboroméite.

Aluminopyracmonite*

F. Demartin, C. Castellano, and I. Campostrini (2013) Aluminopyracmonite, $(NH_4)_3Al(SO_4)_3$, a new ammonium aluminium sulfate from La Fossa crater, Vulcano, Aeolian Islands, Italy. Mineralogical Magazine, 77(4), 443–451.

Aluminopyracmonite (IMA 2012-075), ideally $(NH_4)_3Al(SO_4)_3$, is a new mineral from La Fossa crater, Vulcano, Aeolian Islands, Sicily, Italy. It occurs in an active, medium-temperature (~250 °C) intracrater fumarole developed on a pyroclastic breccia. The mineral occurs in assemblage with adranosite, mascagnite, alunite and salammoniac, and forms aggregates of colorless to white, elongate, hexagonal prismatic crystals up to 0.2 mm long. No twinning is apparent. The streak is white and the luster is vitreous. Cleavage and fracture were not observed. Mohs hardness was not reported. The measured density is 2.12(1) g/cm^3, D_{calc} = 2.143 g/cm^3. Aluminopyracmonite is optically uniaxial (–), ω = 1.545(3), and ε = 1.532(3) (λ = 589 nm). The mineral is not hygroscopic and is stable on the air. No fluorescence was observed under SW or LW ultraviolet radiation. Evidence for ammonium was confirmed by the IR spectrum that shows absorption peaks at 3208(vs), 3048(s), and 1421(vs) cm^{-1}. Average electron probe EDS analyses [wt% (range)] is: K_2O 1.26 (1.12–1.45), Fe_2O_3 0.30 (0.22–0.40), Al_2O_3 16.07 (14.69–17.63), SO_3 62.22 (60.76–63.46), $(NH_4)_2O$ 20.15 (by difference), total 100 wt%. The empirical formula based on 12 anions pfu is: $[(NH_4)_{2.89}K_{0.10}]_{\Sigma 2.99}(Al_{1.18}Fe_{0.01})_{\Sigma 1.19}S_{2.91}O_{12}$. The strongest lines of the X-ray powder diffraction pattern [d Å (I%; hkl)] are: 3.336 (100; 131), 7.469 (62; 110), 3.288 (60; 122), 4.289 (45; $\bar{2}31$), 2.824 (29; $\bar{3}51$), 4.187 (27; 012). Unit-cell parameters refined from the powder data with cell refinement are: a = 15.009(1), c = 8.863(1) Å. X-ray single-crystal diffraction study on a crystal fragment 80 × 30 × 20 μm shows the mineral is trigonal, space group $R\bar{3}$; a = 15.0324(8), c = 8.8776(5) Å, V = 1737.3 Å^3; Z = 6. In the crystal structure of aluminopyracmonite [refined to R_1 = 0.0258 for 998 unique $I > 2\sigma(I)$ reflections] two types of Al octahedra are linked by corner sharing with (SO_4) tetrahedra with two possible conformation with 2/3 and 1/3 occupation, to form the infinite $[Al(SO_4)_3]_\infty$ chains made by the AlO_6 octahedra which share all their corners with sulfate tetrahedra. The voids located between these parallel chains extending along [001] host the ammonium ions that are hydrogen-bonded with the neighboring oxygen atoms of the sulfate ions not involved in the coordination with Al. While aluminopyracmonite has an analogous chemical formula and similar unit-cell parameters to pyracmonite $[(NH_4)_3Fe^{3+}(SO_4)_3]$ they are not isostructural. The mineral is named on the basis of the chemical analogy with pyracmonite. Holotype material is deposited in the Reference Collection of the Dipartimento di Chimica, Università degli Studi di Milano, Italy. **F.C.**

Bobmeyerite*

A.R. Kampf, J.J. Pluth, Y.-S. Chen, A.C. Roberts, and R.M. Housley (2013) Bobmeyerite, a new mineral from Tiger, Arizona, USA, structurally related to cerchiaraite and ashburtonite. Mineralogical Magazine, 77(1), 81–91.

Bobmeyerite (IMA 2009-019), ideally $Pb_4(Al_3Cu)(Si_4O_{12})(S_{0.5}Si_{0.5}O_4)(OH)_7Cl(H_2O)_3$, is a new mineral from the Mammoth-Saint Anthony mine (32°42′23″N, 110°40′59″W), Tiger, Pinal County, Arizona, U.S.A. It occurs in an oxidation zone assemblage attributed to progressive alteration and crystallization in a closed system. The oxidation zone assemblage includes atacamite, caledonite, cerussite, connellite, diaboleite, fluorite, georgerobinsonite, hematite, leadhillite, matlockite, murdochite, phosgenite, pinalite, quartz, wulfenite, and yedlinite. Bobmeyerite is found as colorless to white or cream-colored needles, up to 300 μm in length (on [001]) less than 2 mm in diameter. No twinning was observed. Crystals are transparent to translucent and have a vitreous luster. Streak is white. Bobmeyerite do not fluoresce in either long- or short-wave ultraviolet light. The hardness and fracture could not be determined because of the very small thickness of the needles. The tenacity is brittle and no cleavage was observed. The density could not be measured; calculated

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* All minerals marked with an asterisk have been approved by the IMA CNMMC.

† For a complete listing of all IMA-validated unnamed minerals and their codes, see http://pubsites.uws.edu.au/ima-cnmnc/.

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density is 4.381 g/cm^3, based on the empirical chemical formula and the unit-cell parameters determined by single-crystal X-ray diffraction. Bobmeyerite dissolves very slowly in concentrated HCl; it is insoluble and unreactive in concentrated H_2SO_4 and 70% HNO_3. Optically bobmeyerite is biaxial (–) with $\alpha \approx \beta = 1.759(2)$, $\gamma = 1.756(4)$, $2V$ was not determined; orientation is $X =$ **c**; Y or $Z =$ **a** or **b**. The absorption bands in 1200–430 cm^{-1} range in the infrared spectrum of bobmeyerite include contributions from SiO_4 tetrahedra and four-member silicate ring. The absence of CO_3 is confirmed by the absence of the CO_3 absorption bands. The presence of OH and H_2O groups is confirmed by the stretching vibrations present at 3386 cm^{-1} and the bending vibration at 1649 cm^{-1}. The average of electron probe WDS analysis [wt% (range)] is: CaO 0.14 (0.12–0.17), PbO 54.83 (53.37–56.48), CuO 4.94 (4.28–6.06), Al_2O_3 10.02 (9.64–10.40), SiO_2 17.09 (16.80–18.01), SO_3 3.00 (2.74–3.20), Cr_2O_3 0.85 (0.44–146), F 0.64 (0.34–0.86), Cl 2.41 (1.80–3.17), H_2O (based on the structure) 6.89 (5.91–8.37) –O=F,Cl 0.81 (0.55–1.04), total 100 wt% (normalized to provide a total of 100 wt% because of the reduced size of needles and rapid dehydration under the beam under vacuum). The empirical formula calculated on the basis of 27 anions (O+Cl+F) pfu is $Pb_{3.80}Ca_{0.04}Al_{3.04}Cu^{2+}_{0.96}Cr^{3+}_{0.13}Si_{4.40}S_{0.58}O_{24.43}Cl_{1.05}F_{0.52}H_{11.83}$. The strongest lines of the X-ray powder diffraction pattern [d Å (I; hkl)] are: 10.051 (35; 110), 5.474 (54; 011,101), 5.011 (35; 220), 4.333 (43; 121,211), 3.545 (34; 040,400), 3.278 (77; 330,231,321), 2.9656 (88; 141,002,411), 2.5485 (93; 051,222,501), 1.873 (39; multiple). Unit-cell parameters refined from the powder data with whole-pattern fitting are: $a = 13.952(3)$, $b = 14.257(3)$, $c = 5.9000(10)$ Å, $V = 1173.6$ Å^3. A crystal of 80 × 2 × 2 μm was used for a single crystal study (ChemMatCARS, Sector 15, Advanced Photon Source at Argonne National Laboratory), yielding orthorhombic symmetry, space group $Pnnm$, $a = 13.969(9)$, $b = 14.243(10)$, $c = 5.893(4)$ Å, $V = 1172.4$ Å^3, $Z = 2$. The crystal structure was solved by direct methods and refined to $R_1 = 7.91\%$ using 1057 [$F \geq 4\sigma(F)$] reflections. Bobmeyerite has the same structural framework as cerchiaraite and ashburtonite, although it is orthorhombic, rather than tetragonal: SiO_4 tetrahedra share corners to form four-membered Si_4O_{12} rings centered on the **c** axis. The rings are linked by chains of edge-sharing AlO_6 octahedra, which also run parallel to [001]. The framework thereby created contains large channels, which run parallel to [001]. The Cl site is centered on the **c** axis and alternates along [001] with the Si_4O_{12} rings. Two non-equivalent Pb atoms are located around the periphery of the channels. Both are 11-coordinated, bonding to the Cl atom on the **c** axis, to eight O atoms in the framework and to two O sites in the channel. They are off-center in these coordinations, as is typical of Pb^{2+} with stereo-active lone-electron pairs. The channels also contains H_2O groups loosely bonded to the Pb atoms. There are S, Cr, and excess Si determined by EMPA, $(S_{0.58}Si_{0.40}Cr^{3+}_{0.13})_{\Sigma 1.11}$, that must be accommodated in the channel, presumably in tetrahedral coordination to O, but FTIR did not confirmed this hypothesis. The name honors Robert (Bob) Owen Meyer (b.1956) of Maple Valley, Washington, U.S.A. He acquired the first mineral from Mammoth-Saint Anthony mine in 1978 and since then he has intensively studied the minerals of that deposit, discovering the first specimen of the rare mineral munakataite. He also predicted the new mineral described with his name. No specimen could be qualified as the holotype. Three cotype specimens are housed in the collections of Mineral Sciences Department, Natural History Museum of Los Angeles County, Los Angeles, California, U.S.A.), catalogue numbers 63824, 63825, and 63826. **F.C.**

Comment: It should be $\alpha = 1.756(4)$, $\beta \approx \gamma = 1.759(2)$°.

HYLBROWNITE*

P. Elliott, J. Brugger, T. Caradoc-Davies, and A. Pring (2013) Hylbrownite, $Na_3MgP_3O_{10} \cdot 12H_2O$, a new triphosphate mineral from the Dome Rock Mine, South Australia: description and crystal structure. Mineralogical Magazine, 77(3), 385–398.

Hylbrownite (IMA2009-016), ideally $Na_3MgP_3O_{10} \cdot 12H_2O$, is a new mineral species from the Dome Rock mine, Boolcoomatta Reserve, Olary Province, South Australia, Australia. The Dome Rock deposit consists of ore-bodies interpreted to be hypergene in origin that are most likely related to the invasion of metasediments by granite intrusives, where mineralizing solutions gained access to the sediments along channels formed either by minor faults or along favorable rock contacts. Secondary phosphate minerals (e.g., hylbrownite) are believed to have formed after a suite of secondary arsenate minerals, though no primary P minerals have been recorded at the mine. Hylbrownite occurs in a thin seam as aggregates and sprays of crystals, overgrowing aggregates of pale green conichalcite, crusts of chrysocolla and crusts of a black, amorphous Cu-Mn-Co silicate with a gray quartzite matrix with very minor goethite and muscovite. On a second specimen, hylbrownite crystal sprays occur on an iron oxide-stained quartzite matrix associated with cuprite, malachite, azurite, and goethite. Crystals of hylbrownite are thin prismatic to acicular up to 0.12 × 0.02 mm, are elongated along [001] and show forms {010}, {100}, {001}, {210}, and {201}. Hylbrownite is colorless to white, is transparent, has a white streak, vitreous luster, is brittle, has good cleavage parallel to {001} and to {100} and has uneven fracture. Mohs hardness was not determined due to the small size of the crystals. $D_{meas} = 1.81(4)$ g/cm^3, $D_{calc} = 1.82$ g/cm^3. Hylbrownite is optically biaxial (–), with $\alpha = 1.390(4)$, $\beta = 1.421(4)$, $\gamma = 1.446(4)$, and $2V_{calc} = 82.2$°. The mineral is non-fluorescent and nonpleochroic. The main absorption bands of the IR spectrum (cm^{-1}) are: 3278 (OH-stretching vibrations); 1670 and 1643 (H-O-H bending of H_2O groups); 1254, 1118, 1022, 995, and 906 (asymmetric stretching vibrations of PO_3 groups); 906 and 742 (O-P-O stretching vibrations); 692 and 658 (O-P-O bending vibrations). The average of 9 electron probe WDS analyses gives [wt% (range)]: Na_2O 16.08 (15.11–17.15), MgO 7.08 (5.56–8.94), CaO 0.43 (0.18–0.63), P_2O_5 37.60 (35.7–40.28), H_2O 38.45 (calc. from ideal formula based on structure determination), total 99.64 wt%. The empirical formula $Na_{2.93}Mg_{0.99}Ca_{0.04}P_{2.99}O_{9.97} \cdot 12.03H_2O$ based on 22 O apfu. The strongest lines in the X-ray powder-diffraction pattern [d Å (I%; hkl)] are: 10.530 (60; $10\bar{1}$,101), 7.357 (80; 200), 6.951 (100; $11\bar{1}$,111), 4.754 (35; $10\bar{3}$,103), 3.934 (40; 022), 3.510 (45; $30\bar{3}$,303), 3.336 (35; $41\bar{1}$,411). The unit-cell parameters refined from powder-diffraction data are: $a = 14.716(2)$, $b = 9.247(2)$, $c = 15.034(2)$ Å, $\beta = 89.89(2)$°, $V = 2045.9$ Å^3. Single-crystal

X-ray synchrotron light diffraction data collected at $T = 123$ K on a crystal of size $55 \times 6 \times 6$ μm refined to $R_1 = 0.045$ for 2313 unique reflections with $I \geq 4\sigma(I)$ shows hylbrownite is monoclinic, space group $P2_1/n$, with $a = 14.722(3)$, $b = 9.240(2)$, $c = 15.052(3)$ Å, $\beta = 90.01(3)°$, $V = 2047.5$ Å^3, and $Z = 4$. The structure consists of $[Mg(H_2O)_3P_3O_{10}]$ clusters linked in the *b* direction to Na octahedra by face and corner sharing, and of 6- and 7-coordinated Na polyhedra that form Na_2O_9 groups that form chains in the *b* direction via corner sharing. The clusters and chains link in the *c* direction to form thick sheets parallel to (100) that are linked in the *a* direction via hydrogen bonds. The new mineral is named in honor of Henry Yorke Lyell Brown (1844–1928), Government Geologist of South Australia from 1882 to 1912, for his first recorded observations of the interior of the state of South Australia and the Northern Territory leading to the first geological map of the whole colony in 1899. The holotype specimen is preserved in the collection of the South Australian Museum, Adelaide, South Australia. **O.C.G.**

KIHLMANITE-(CE)*

V.N. Yakovenchuk, S.V. Krivovichev, G.Y. Ivanyuk, Ya.A. Pakhomovsky, E.A. Selivanova, E.A. Zhitova, G.O. Kalashnikova, A.A. Zolotarev, J.A. Mikhailova, and G.I. Kadyrova (2014) Kihlmanite-(Ce), $Ce_2TiO_2[SiO_4](HCO_3)_2(H_2O)$, a new rare-earth mineral from the pegmatites of the Khibiny alkaline massif, Kola Peninsula, Russia. Mineralogical Magazine, 78(3), 483–496.

Kihlmanite-(Ce) (IMA 2012-081), ideally $Ce_2TiO_2[SiO_4](HCO_3)_2(H_2O)$, was discovered in a vein consisting of arfvedsonite-aegirine-microcline in fenitized metavolcanic rock at the foot of the Mt Kihlman, near western contact of the Khibiny alkaline massif and the Imandra-Varzuga greenstone belt. The mountain was named after Alfred Oswald Kihlman (Kairamo), a Finnish geographer and botanist, and a member of the Wilhelm Ramsay expeditions; and the mineral is therefore named after the type locality and Alfred Oswald Kihlman. The mineral was found in a large, symmetrically zoned pegmatitic vein, varying from 0.5 to 2 m in width and 280 m long hosted by fenite. The vein selvages are ~25 cm wide and are consist of acicular arfvedsonite with minor albite, eudialyte, lamprophyllite, and astrophyllite. Intermediate vein zones (30–70 cm) and are composed of fine-grained albite, black acicular aegirine and ochre-brown rinkite. In some places, there are granular segregations of natrolite and willemite (up to 2 cm); fluorapatite, lorenzenite, vinogradovite, fluorite, ancylite-(Ce), loparite-(Ce), radiating aggregates (up to 2 cm) of golden-green tundrite-(Ce) and reddish-brown kihlmanite-(Ce). In places, kihlmanite-(Ce) forms close intergrowths with tundrite-(Ce). Vein's axial zone is composed of large tabular crystals of microcline (up to 12 cm in diameter), with massive nepheline and sodalite, radiating aggregates of aegirine and also with loparite-(Ce), rinkite, eudialyte, aenigmatite, arfvedosnite, and anhedral grains of sphalerite and galena. Tundrite-(Ce) and kihlmanite-(Ce) are considered to be products of low-temperature hydrothermal alteration of rinkite and loparite-(Ce), and are commonly intergrown. The new mineral occurs in the form of brown spherulites up to 2 cm in diameter and aggregates of prismatic crystals up to 0.5 mm in diameter. These crystals are elongated along [001] and flattened on {010}, with the common {010}, {100}, {001}, {110}, and {011} forms. Kihlmanite-(Ce) has a perfect cleavage on (010), parting perpendicular to [001]; and no twinning. It is brittle, has a stepped fracture and Mohs hardness of 3; $D_{meas} = 3.66(2)$, $D_{calc} = 3.694$ g/cm^3. The new mineral is brown, transparent, with a pale yellowish-brown streak. The luster is vitreous and silky in aggregates. No fluorescence under UV light was observed. In transmitted light kihlmanite-(Ce) is yellowish-brown, with no pleochroism. It is optically biaxial (+), $\alpha = 1.708(5)$, $\beta = 1.76(1)$, and $\gamma = 1.82(1)$ (589 nm), $2V_{calc} = 89(5)°$, $Y \wedge c = 5°$. The averaged 6 point electron probe WDS analyses on the holotype crystal gave (wt%): Na_2O 0.13(±0.85), Al_2O_3 0.24(±0.17), SiO_2 9.91(±1.10), CaO 1.50(±0.38), TiO_2 11.04(±1.28), MnO 0.26(±0.26), Fe_2O_3 0.05(±0.03), Nb_2O_5 2.79(±0.85), La_2O_3 12.95(±3.25), Ce_2O_3 27.33(±1.41), Pr_2O_3 2.45(±0.55), Nd_2O_3 8.12(±0.97), Sm_2O_3 1.67(±0.19), Gd_2O_3 0.49(±0.58), [CO_2 15.00 and H_2O 6.00 (by Penfield method)], total 99.93 wt%. The empirical formula of the holotype kihlmanite-(Ce) is $(Ca_{0.16}Na_{0.11}Mn_{0.02})_{\Sigma 0.29}[(Ce_{0.98}La_{0.47}Pr_{0.09}Nd_{0.29}Sm_{0.06}Gd_{0.02})_{\Sigma 1.91}(Ti_{0.82}Nb_{0.12})_{\Sigma 0.94}O_2(Si_{0.97}Al_{0.03})_{\Sigma 1.00}O_{4.02}(HCO_3)_{2.01}](H_2O)_{0.96}$ (based on Si+Al = 1 apfu). The FTIR spectrum shows bands (cm^{-1}, s = strong, w = weak, sh = shoulder) between 400 and 950 (Si-O vibrations); at 846–943 (symmetric stretching vibrations of isolated SiO_4 groups), 557 (bending vibrations of isolated SiO_4 groups); 1520s, 1385s (asymmetric stretching vibrations of the $[CO_3]^{2-}$ or $[HCO_3]^-$ groups); 1054ms, 1020ms (symmetric stretching vibrations of the $[HCO_3]^-$ groups), 1620sh (bending vibrations of H_2O molecules); 653s, 700 (in-plane bending vibrations of the $[CO_3]^{2-}$ or $[HCO_3]^-$ groups); 1780w (asymmetric stretching vibrations of the $[CO_3]^{2-}$ groups); ~3380, 2850, and 2920 (O-H stretching vibrations). The strongest lines of the X-ray powder diffraction pattern are [*d* Å (*I*%; *hkl*)]: 15.11 (100; 00$\bar{1}$), 7.508 (20; 00$\bar{2}$), 6.912 (12; 0$\bar{1}$1), 4.993 (14; 00$\bar{3}$), 3.563 (15; 0$\bar{2}$1), 2.896 (15; 1$\bar{2}\bar{2}$). The crystal structure of kihlmanite-(Ce) was solved by direct methods and refined to $R_1 = 6.9\%$. The mineral is triclinic, $P\bar{1}$, $a = 5.009(5)$, $b = 7.533(5)$, $c = 15.407(5)$ Å, $\alpha = 103.061(5)$, $\beta = 91.006(5)$, $\gamma = 109.285(5)°$, $V = 531.8$ Å^3, and $Z = 2$. The crystal structure of kihlmanite-(Ce) is based on complex $[Ce_2TiO_2(SiO_4)(HCO_3)_2]$ layers running parallel to (001). These layers are built by of chains of edge-sharing TiO_2 octahedra linked by isolated $[SiO_4]$ tetrahedra. The Ce^{3+} cations are coordinated by $[HCO_3]^-$ groups and are on both sides of the sheets formed by Ti octahedra and Si tetrahedra. There are two Ca sites: one site is located in the interlayer space and is 25% occupied, and another one is located between the chains of edge-sharing $[TiO_6]$ octahedra and is 20% occupied. The crystal structure of kihlmanite-(Ce) is related to that of tundrite-(Ce). The type material is deposited in the collections of the Mineralogical Museum of St. Petersburg State University, Russia, and in the Geological and Mineralogical Museum of the Geological Institute of the Kola Science Centre, Apatity, Russia. **Yu.U.**

KLEBERITE*

I.E. Grey, K. Steinike, and C.M. MacRae (2013) Kleberite, $Fe^{3+}Ti_6O_{11}(OH)_5$, a new ilmenite alteration product, from Königshain, northeast Germany. Mineralogical Magazine, 77(1), 45–55.

Kleberite (IMA 2012-023), ideally $Fe^{3+}Ti_6O_{11}(OH)_5$, is a new mineral from Tertiary sands at Königshain, Saxony, northeast Germany. It is also found in heavy mineral sands from the Murray Basin, southeast Australia, and at Kalimantan, Indonesia. Ilmenite, pseudorutile, "leucoxene," tourmaline, and spinel are present in the heavy mineral concentrates at all three localities. The mineral was first described by Steinike in 1963. Grains were distinguished from other heavy minerals by their striking red brown translucent appearance. As part of a uranium confidential exploration project, the discovery was not made public until 1978, when the mineral was described by Bautsch et al. (1978) and given the name kleberite (without IMA approval) in "a thoroughly unsatisfactory description" (M. Fleischer in Fleischer et al. 1979). Optical examination of sectioned grains revealed ilmenite cores in some grains, suggesting that kleberite formed by the alteration of ilmenite (Bautsch et al. 1978), although with lower iron content and higher water content than those reported by Grey and Reid (1975) as pseudorutile, an alteration of ilmenite. A detailed crystallographic study of samples from the Kalimantan (Grey et al. 2010) showed kleberite to be a structural analogue of tivanite, $V^{3+}TiO_3OH$, and named it hydroxylian pseudorutile. The study of German material confirmed the similarity with Kalimantan and Murray Basin samples. Kleberite occurs as rounded anhedral to euhedral translucent grains, 0.04–0.3 mm across, which are generally red-brown, but grade to orange with decreasing iron content. Residual MgO-bearing ferrian ilmenite is found in some kleberite grains. The grains have a waxy to vitreous appearance and a beige-colored streak. They are relatively brittle with an irregular fracture. D_{meas} = 3.28 g/cm^3 (by pycnometry) is lower than D_{calc} = 3.91 g/cm^3 due to intragrain porosity which is not penetrated by the immersion fluid. In transmitted light kleberite grains are slightly cloudy, with colors ranging from yellow through red-brown to deep red. The grains are optically uniaxial (–), but localized regions are weakly biaxial (–) with $2V$ close to zero. Birefringence is 0.04–0.05 (Bautsch et al. 1978). The mean refractive index, calculated from reflectance measurements, is 2.16(3). The average of 15 electron probe WDS analysis [wt% (range)] is: TiO_2 65.9 (59.0–70.1), Fe_2O_3 11.2 (9.0–15.9), Al_2O_3 4.20 (2.04–7.86), SiO_2 2.57 (1.48–3.12), P_2O_5 0.51 (0.21–0.98), V_2O_5 0.50 (0–0.88), MnO 0.07 (0–0.15), MgO 0.31 (0.15–0.50), H_2O 10.6 (TGA), total 95.9 wt%. The empirical formula calculated on the basis of 6 apfu of Ti and 16 (O+OH) pfu (with the O:OH ratio adjusted to maintain charge balance) is (intrapore impurity compositions shown in square brackets) $Fe^{3+}_{1.01}Mg_{0.06}Ti_6O_{11.2}(OH)_{4.8}[Al_{0.59}Si_{0.31}P_{0.04}O_{1.60}\cdot 1.8H_2O]$ for Königshain kleberite, $Fe^{3+}_{0.89}Mg_{0.10}Ti_6O_{10.9}(OH)_{5.1}[Al_{0.34}Si_{0.19}P_{0.04}O_{0.99}\cdot 1.6H_2O]$ for Murray Basin kleberite, and $Fe^{3+}_{1.00}Mg_{0.04}Ti_6O_{11.1}(OH)_{4.9}[(AlOOH)_{1.8}Si_{0.15}P_{0.06}O_{0.45}\cdot 1.7H_2O]$ for Kalimantan kleberite. The strongest lines of the X-ray powder diffraction pattern [d Å (I%; hkl)] are: 3.933 (8; 011,$\bar{1}$11), 2.764 (9; $\bar{2}$11,$\bar{1}$13), 2.466 (27; 102,$\bar{3}$02,$\bar{2}$04), 2.170 (82; 112,$\bar{3}$12,$\bar{2}$14), 1.676 (100; 122,$\bar{3}$22,$\bar{2}$24), 1.423 (22; 400,$\bar{1}$06). Powder XRD pattern can be indexed with an hexagonal cell with a = 2.845(1), c = 4.575(1) Å. But single-crystal data showed that this cell could not satisfactorily explain the observed reflections. The cell was considered hexagonal because of multiple twinning, while actually is monoclinic like tivanite. Rietveld refinement of powder data starting form the coordinates of tivanite, with a monoclinic model in space group $P2_1/c$, converged to R_p = 6.3 % and a = 7.537(1), b = 4.5795(4), c = 9.885(1) Å, β = 131.02(1)° (V = 257.42 Å^3, calculated from published lattice parameters). The structure can be described as a unit-cell scale intergrowth of goethite-type M(2)O(OH) [with M(2) occupied by V^{3+} in tivanite and Ti^{4+} in kleberite] and rutile-type M(1)O2 structural elements, with the intergrowth plane parallel to (100). Kleberite with structural formula $[Ti^{4+}_3\square][Ti^{4+}_3Fe^{3+}]O_{11}(OH)_5$ is related to isostructural tivanite $[Ti^{4+}_4][V^{3+}_4]O_{12}(OH)_4$, and to pseudorutile $[Ti_4][(Fe^{3+},Ti)_4](O,OH)_{16}$. Kleberite is named in honor of Will Kleber (1906–1970), a former director of the Institute of Mineralogy and the Museum of Mineralogy at Humboldt University, Berlin, for his seminal contributions to crystallography research and education, and for his major research contributions in the fields of crystal growth, epitaxy and topotaxy. Type material from Königshain, Saxony, Germany is catalogued in the mineral collection of the Museum für Naturkunde, Humboldt University, Berlin, Germany. Cotype specimens of kleberite from the Murray Basin and Kalimantan are preserved in the collections of Museum Victoria, Melbourne, Victoria, Australia. **F.C.**

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LEYDETITE*

J. Plášil, A.V. Kasatkin, R. Škoda, M. Novák, A. Kallistová, M. Dušek, R. Skála, K. Fejfarová, J. Čejka, N. Meisser, H. Goethals, V. Machovič, and L. Lapčák (2013) Leydetite, $Fe(UO_2)(SO_4)_2(H_2O)_{11}$, a new uranyl sulfate mineral from Mas d'Alary, Lodève, France. Mineralogical Magazine, 77(4), 429–441.

Leydetite (IMA 2012-065), ideally $Fe(UO_2)(SO_4)_2(H_2O)_{11}$, is a new supergene uranyl sulfate from Mas d'Alary, Lodève, Hérault, France. Leydetite probably formed during the last stage of at least three U-mobilization stages, occurring in U-deposits in the Permian Lodève basin, due to major tectonic events in the area. Associated minerals include abundant pyrite, less abundant uraninite (which however forms omnipresent inclusions in coal), calcite, quartz, unspecified clay minerals, gypsum, and deliensite. Leydetite occurs as pale yellow to greenish, tabular, transparent to translucent crystals, up to 2 mm, with a strong vitreous luster and a yellowish white streak. It is brittle with an excellent cleavage on {001}. The Mohs hardness is ~2; D_{calc} = 2.55 g/cm^3. Leydetite is non-fluorescent under short- or long-wavelength UV radiation. In transmitted light, it is colorless non-pleochroic. Optical determinations are compromised by the intergrowths and polysynthetic twinning. Refractive indices measured on a cleaved on (001) fragments are α′ = 1.513(2) and γ′ = 1.522(2) (590 nm). Raman and FTIR spectrum shows bands (in cm^{-1}; FTIR values in italics) at 3492, 3404, 3237, 3130, 3526, 3461, 3376, and 3169 (assigned to ν(O–H) stretching vibrations of symmetrically non-equivalent H_2O molecules), 1679, 1649, 1641 [ν_2(H–O–H) bending vibrations of H_2O molecules] 1203, 1180, 1150, 1139, 1135, 1113, 1099, 1166, and 1104 (split triply degenerate ν_3 antisymmetric stretching vibrations of SO_4), 1038, 1030, 1023, 1015, 1024, and 1001 (ν_1 symmetric stretching vibrations of SO_4 groups), 937, 930, 935, and 916 (ν_3 antisymmetric stretching vibrations of UO_2^{2+}), 858, 851, 846, 843, 836, and 828 (ν_1 symmetric stretching modes of UO_2^{2+}), 686, 675, 666, 608, 630, and 588 [split triply degenerate $\nu_4(\delta)$ SO_4 bending vibrations], 538, 522, and 504 [(U–O_{ligand}) stretching vibrations and librations of H_2O molecules] 485, 464, 443, 420, 472, and 432 [split doubly degenerate $\nu_1(\delta)$ SO_4 bending vibrations], 290, 260, 236, and 223 [split doubly degenerate $\nu_2(\delta)$ UO_2^{2+} bending vibrations] 196, 182, 165, 138, 123, 116, 102, 89, 77, and 65 (lattice modes). The average of not reported number of electron probe WDS analysis [wt% (range)] is: FeO 10.88 (10.65–11.10), CuO 0.16 (0.00–0.31), MgO 0.43 (0.25–0.55), Al_2O_3 0.31 (0.11–0.46), SiO_2 0.21 (0.10–0.40), SO_3 25.68 (24.07–26.88), UO_3 47.10 (46.01–47.89), H_2O (based on a content of 11 H_2O from the crystal structure) 32.65, total 117 (114.63–120.68) wt%, which normalized to provide a total of 100 wt% (no explanation provided) yields FeO 9.28, CuO 0.14, MgO 0.36, Al_2O_3 0.26, SiO_2 0.18, SO_3 21.91, UO_3 40.19, H_2O 27.67, total 100 wt%. The empirical formula calculated on the basis of 21 O pfu is $Fe_{0.93}Mg_{0.07}Al_{0.04}Cu_{0.01})_{\Sigma1.05}(U_{1.01}O_2)(S_{1.96}Si_{0.02})_{\Sigma1.98}O_8(H_2O)_{11}$. The strongest lines of the X-ray powder diffraction pattern [*d* Å (*I*%; *hkl*)] are: 10.625 (100; 002), 6.277 (1*; $\bar{1}11$), 5.321 (66; 004), 3.549 (5; 006), 2.663 (4; 008), 2.131 (2; 0 0 10) (* observed value, calculated = 42). Unit-cell parameters refined from the powder data with whole-pattern fitting are: a = 11.319(3), b = 7.723(1), c = 21.826(3) Å, β = 102.41(3)°, V = 1863.7 Å^3. An crystal of 0.45 × 0.22 × 0.05 mm was used for a single crystal study, yielding a monoclinic symmetry, space group *C*2/*c*, a = 11.3202(3), b = 7.7293(2), c = 21.8145(8) Å, β = 102.402(3)°, V = 1864.18(10) Å^3, Z = 4. The structure was solved by charge-flipping algorithm and refined to R_1 = 0.0224 using 2159 [$I \geq 3\sigma(I)$] reflections. Leydetite is isostructural with the synthetic compound $Mg(UO_2)(SO_4)_2(H_2O)_{11}$. Leydetite possesses a sheet structure based upon the protasite $[Ba(UO_2)_3O_3(OH)_2·3H_2O]$ anion topology: a sheet consists of UO_7 bipyramids, which share four of their equatorial vertices with SO_4 tetrahedra; each SO_4 tetrahedron, in turn, shares two of its vertices with UO_7 bipyramids. The remaining unshared equatorial vertex of the bipyramid is occupied by a H_2O group, which extends hydrogen bonds within the sheet to one of a free vertex of the SO_4 tetrahedron. Sheets are stacked perpendicular to the **c** direction. In the interlayer, Fe^{2+} ions and H_2O groups link to the sheets on either side via a network of hydrogen bonds. is named in honor of Jean-Claude Leydet (b.1961), an amateur mineralogist and mineral collector from Brest, France, who discovered the new mineral and is especially known for his studies of uranium-bearing minerals. The holotype specimen of leydetite is deposited in the collections of the Musée Cantonal de Géologie, Lausanne, Switzerland. **F.C.**

NESTOLAITE*

A.V. Kasatkin, J. Plášil, J. Marty, A.A. Agakhanov, D.I. Belakovsky, and I.S. Lykova (2014) Nestolaite, $CaSeO_3·H_2O$, a new mineral from the Little Eva mine, Grand County, Utah, USA. Mineralogical Magazine, 78(3), 497–505.

Nestolaite (IMA 2013-074), ideally $CaSeO_3·H_2O$, is a new mineral from the underground Little Eva mine, Yellow Cat district, Grand County, Utah, U.S.A. It is named in honor of Fabrizio Nestola, a prominent Italian mineralogist and crystallographer. The Little Eva was mined for U and V, with grades up to 10% V_2O_5 and 0.4% U_3O_8. The mineralization is hosted within interstratified units of sandstone and claystone. High-grade concentrations of U and V minerals occur in masses and pods commonly associated with carbonaceous material. Selenium is also present in the system with concentrations reaching up to 15 ppm in sandstones. Primary Se minerals, such as native Se and ferroselite, were exposed to surface conditions after the mine closure and underwent supergene alteration leading to the formation of nestolaite. The new mineral is rare and is associated with cobaltomenite, gypsum, metarossite, orschallite, and rossite. The general mineral assemblage in the Little Eva mine also includes andersonite, ansermetite, calciodelrioite, calcite, carnotite, ferrosilite, huemulite, lasalite, martyite, melanovanadite, nashite, native Se, natrozippeite, pascoite, pyrite, schröckingerite, sherwoodite, and uraninite. The new mineral forms rounded aggregates up to 2 mm across and up to 0.05 mm thick, light violet in color, on the surface of sandstone. The aggregates themselves consist of intergrown oblique-angled, flattened to acicular crystals up to 30 μm long and up to 7 μm thick. Nestolaite is transparent, with a white streak and a vitreous luster. It is brittle, has an uneven fracture, a perfect cleavage on {100}, and Mohs hardness of 2½; D_{meas} = 3.18(2) g/cm^3, D_{calc} = 3.163 g/cm^3. The mineral is not fluorescent. Nestolaite is optically biaxial (+), α = 1.642(3), β = 1.656(3), and γ = 1.722(6); 2V = 55(5)° and 2V_{calc} = 51°; non-pleochroic but has strong pseudo-absorption caused by high birefringence; many crystals show straight extinction. The bands on the Raman spectra (cm^{-1}) are: ~825 (highest intensity), ~750, ~470, and 410–370, dominantly associated with Se-O stretching vibrations of SeO_3 groups. The characteristic O-H stretching frequencies are present between 3400 and 3200 cm^{-1}, and the H-O-H bending vibration of the H_2O group occurs at 1680 cm^{-1}. The average of 5 electron probe WDS analyses is [wt% (range)]: CaO 28.97 (27.30–30.86), SeO_2 61.14 (59.36–62.93), H_2O 9.75 (by stoichiometry), total 99.86. The empirical formula calculated on the basis of 4 oxygen apfu is: $Ca_{0.96}Se_{1.02}O_3·H_2O$. The strongest lines of the X-ray powder diffraction patterns [*d* Å (*I*%; *hkl*)] are: 7.277 (100; 100), 4.949 (37; 110), 3.767 (29; 002), 3.630 (58; 200), 3.371 (24; 020), 3.163 (74; $\bar{2}02$), 2.9783 (74; $\bar{1}21$), 2.7231 (31; 112). Nestolaite is monoclinic, space group $P2_1/c$, a = 7.6502(9), b = 6.7473(10), c = 7.9358(13) Å, β = 108.542(12)°, V = 388.37(10) Å^3, Z = 4. Rietveld refinement of powder X-ray diffraction data was performed to prove the structural equivalence of nestolaite to the synthetic $Ca(SeO_3)(H_2O)$. The refinement converged to R_F = 4.88% and GoF = 1.61. The crystal structure of nestolaite is a layered structure in which sheets of edge-sharing CaO-H_2O polyhedral are interconnected by the $(SeO_3)^{2-}$ groups. Calcium cations are [7]-coordinated within the sheet. The Se^{4+} cations of the (SeO_3) groups are all stacked up towards the interlayer, suggesting that there is an active lone electron pair. The adjacent sheets are linked through hydrogen bonds. The type specimen is deposited in the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. **Yu.U.**

PARATACAMITE-(MG)*, PARATACAMITE-(NI)*

A.R. Kampf, M.J. Sciberras, P. Leverett, P.A. Williams, T. Malcherek, J. Schlüter, M.D. Welch, M. Dini, and A.A. Molina Donoso (2013) Paratacamite-(Mg), $Cu_3(Mg,Cu)Cl_2(OH)_6$; a new substituted basic copper chloride mineral from Camerones, Chile. Mineralogical Magazine, 77(8), 3113–3124.

M.J. Sciberras, P. Leverett, P.A. Williams, D.E. Hibbs, P.J. Downes, M.D. Welch, and A.R. Kampf (2013) Paratacamite-(Ni), $Cu_3(Ni,Cu)Cl_2(OH)_6$, a new mineral from the Carr Boyd Rocks mine, Western Australia. Australian Journal of Mineralogy, 17(1), 39–44.

Paratacamite-(Mg) (IMA 2013-014), $Cu_3(Mg,Cu)Cl_2(OH)_6$, and paratacamite-(Ni) (IMA 2013-013), $Cu_3(Ni,Cu)Cl_2(OH)_6$, are two new minerals isomorphous with paratacamite $Cu_3CuCl_2(OH)_6$.

Paratacamite-(Mg) was discovered at Cuya NE5 chloride occurrence near the village of Cuya, Camarones Valley, Arica Province, Chile. The marine sediments of the area (shales and sandstones) bearing sulfide accumulations (pyrite with lesser chalcopyrite and arsenopyrite). Its near-surface low-temperature oxidations under increasingly arid conditions produced extensive suites of secondary sulfates, arsenates, arsenites, chlorides, etc. Paratacamite-(Mg) occurs in association with anhydrite, atacamite, chalcopyrite, copiapite, dolomite, epsomite, haydeeite, hematite, magnesite, and quartz. Crystals of paratacamite-(Mg) up to 0.3 mm are overgrown by layers of haydeeite crystals. Most crystals are formed by combinations of {201} and {001} having a pseudo-octahedral habit. Crystals are twinned by reflection on $\{10\overline{1}\}$ form thick to thin prisms elongated on [212]. Paratacamite-(Mg) is medium to dark green, transparent with a light green streak and vitreous luster. It is brittle, has a conchoidal fracture and perfect cleavage on {201}. The Mohs hardness is 3–3½; D_{meas} = 3.50(2), D_{calc} = 3.551 g/cm^3. Paratacamite-(Mg) does not fluoresce in long- and short-wave UV light. It is uniaxial (–), $\varepsilon = 1.785(5)$, $\omega > 1.8$. The average of 22 electron probe WDS analyses is [wt%, (range)]: CuO 69.34 (59.98–77.87), NiO 0.10 (0–0.37), MnO 0.17 (0.03–0.37), MgO 6.29 (3.58–10.54), CoO 0.08 (0–0.15), Cl 15.47 (14.59–16.32), H_2O 13.52 (by stoichiometry), $–O=Cl_2$ = 3.50, total 101.47. The formula calculated on the basis of 8 (O+Cl) pfu is: $Cu_{3.00}(Mg_{0.62}Cu_{0.49}Mn_{0.01}Ni_{0.01})_{\Sigma 1.13}Cl_{1.74}(OH)_6$. The strongest lines of the X-ray powder diffraction patterns [d Å (I%; hkl)] are: 5.469 (87; 021), 4.686 (26; 003), 2.904 (34; 401), 2.762 (100; $22\overline{3}$,042), 2.265 (81; 404), 1.819 (26; 603), 1.710 (34; 440), 1.380 (19; 446). The crystal structure of paratacamite-(Mg) was solved by direct methods and refined to R_1 = 8.66%. The mineral is trigonal, $R\overline{3}$, a = 13.689(1), c = 14.025(1) Å, V = 2275.8 Å^3, and Z = 12. The holotype and two co-type specimens are deposited in the collections of the Natural History Museum of Los Angeles County, U.S.A.

Paratacamite-(Ni) was found on two gillardite specimens in the collection of Western Australian Museum originating from the Carr Boyd Rocks Ni mine, Western Australia. The specimen G3520 (new number WAM M365.2003) is considered to be a holotype. Paratacamite-(Ni) occurs as a thin crust on an altered ultramafic rock from an oxidation zone and is closely associated with gillardite, spangolite, and gypsum. It is a supergene mineral formed by the oxidation of pentlandite in a saline environment. The general assemblage includes azurite, malachite, gaspéite, magnesite, carrboydite (TL), chalconatronite, georgeite (TL), glaukosphaerite, hydrohonessite, pecoraite, reevesite, takovite, nickelblödite (TL), covellite, digenite, and morenosite. Paratacamite-(Ni) forms aggregates up to ~2 mm with an individual equant rhombohedral crystals up to 0.25 mm. The crystals exhibit forms {101}, {021}, and {001}. No twinning was observed. The mineral is dark green with a light-green streak, transparent, vitreous. It has good cleavage on {101}, no parting, and an uneven fracture. The Mohs hardness is 3; D_{meas} = 3.70, D_{calc} = 3.735 g/cm^3. No fluorescence under UV light was observed. Paratacamite-(Ni) is optically uniaxial (–) with ω and $\varepsilon > 1.8$ (reacts with a standard immersion fluids with $n > 1.8$), n_{calc} = 1.81. The average of 8 electron probe WDS analyses is (wt%, range): CuO 62.43 (61.16–64.37), NiO 12.61 (11.21–13.25), MgO 0.03 (0–0.13), CoO 0.31 (0.24–0.38), Cl 17.60 (17.25–17.78), H_2O 13.04 (by stoichiometry), $–O=Cl_2$ 3.98, total 102.04. The empirical formula $Cu_3(Ni_{0.71}Cu_{0.25}Co_{0.02})_{\Sigma 0.98}Cl_{2.06}(OH)_6$ based on 8 (O+Cl) pfu. The strongest reflections in the X-ray powder diffraction pattern are [d Å (I%; hkl)]: 5.445 (81; 021), 4.637 (13; 003), 4.505 (8; 202), 2.894 (21; 401), 2.751 (100; 223), 2.254 (65; 404), 1.815 (14; 603), 1.708 (9; 440). The new mineral is trigonal, space group $R\overline{3}$, a = 13.682(2), c = 13.916(2) Å, V = 2256.0 Å^3, Z = 12.

The crystal structure of paratacamite-(Mg) and paratacamite-(Ni) consists of sheets of edge-sharing $[CuCl_2(OH)_4]$ octahedra with typical Jahn-Teller distortion. There are two octahedral metal sites in between the adjacent sheets, $M1$ and $M2$, occupied by Cu and other cations, primarily Mg or Ni. In paratacamite-(Mg), Mg is statistically distributed between the $M1$ and $M2$, giving 60% occupancy for both. The Ni occupancy of M2 in paratacamite-(Ni) is 71%. Based on M2-O bond length and reduced distortion associated with the $M2O_6$ octahedron it is suggested that paratacamite-(Ni) is very close to the upper limit of Ni^{2+} occupation in the $R\overline{3}$ structure. **Yu.U., D.B.**

PYROCHLORE SUPERGROUP MINERALS: FLUORCALCIOROMEITE*, OXYCALCIOROMÉITE*, OXYPLUMBOROMÉITE* FLUORCALCIOMICROLITE*, HYDROXYCALCIOPYROCHLORE*

D. Atencio, M.E. Ciriotti, and M.B. Andrade (2013) Fluorcalcioroméite, $(Ca,Na)_2Sb^{5+}_2(O,OH)_6F$, a new roméite-group mineral from Starlera mine, Ferrera, Grischun, Switzerland: description and crystal structure. Mineralogical Magazine, 77(4), 467–473.

C. Biagioni, P. Orlandi, F. Nestola, and S. Bianchin (2013) Oxycalcioroméite, $Ca_2Sb_2O_6O$, from Buca della Vena mine, Apuan Alps, Tuscany, Italy: a new member of the pyrochlore supergroup. Mineralogical Magazine, 77(7), 3027–3037.

U. Hålenius and F. Bosi (2013) Oxyplumboroméite, $Pb_2Sb_2O_7$, a new mineral species of the pyrochlore supergroup from Harstigen mine, Värmland, Sweden. Mineralogical Magazine, 77(7), 2931–2939.

M.B. Andrade, D. Atencio, A.I.C. Persiano, and J. Ellena (2013) Fluorcalciomicrolite, $(Ca,Na,\square)_2Ta_2O_6F$, a new microlite-group mineral from Volta Grande pegmatite, Nazareno, Minas Gerais, Brazil. Mineralogical Magazine, 77(7), 2989–2996.

G. Yang, G. Li, M. Xiong, B. Pan, and C. Yan (2014) Hydroxycalciopyrochlore, a new mineral species from Sichuan, China. Acta Geologica Sinica (English Edition), 88(3), 748–753.

Five pyrochlore-supergroup minerals were recently described. Their general chemical formula $A_{2-m}B_2X_{6-w}Y_{1-n}$ (m = 0–1.7, w = 0–0.7, n = 0–1.0) where A represents large [8]-coordinated cations (Na, Ca, Ag, Mn, Sr, Ba, Fe^{2+}, Pb, Sn^{2+}, Sb^{3+}, Bi^{3+}, Y, REE, Sc, U, Th), a vacancy (□) or H_2O. The A atoms occupy cavities in the framework of edge sharing BX_6 octahedra where B is mainly Ta, Nb, Ti, Sb^{5+}, W, or less commonly V^{5+}, Sn^{4+}, Zr, Hf, Fe^{3+}, Mg, Al, and Si. The site X is typically occupied by O, but can also contain minor OH and F. The Y is an anion (OH, F, O), but can also be a vacancy, H_2O, or a very large monovalent cation (e.g., K, Cs, Rb). According to the present pyrochlore supergroup nomenclature (Atencio et al. 2010) the dominance of Ta, Nb, Ti, Sb^{5+}, or W in the B site defines the group name within the supergroup (microlite, pyrochlore, betafite, roméite, elsmoreite, respectively) and the root of a mineral species name. The first prefix in the mineral name refers to the dominant anion (or cation) of the dominant valence [or H_2O or □] at the Y site. The second prefix refers to the dominant cation of the dominant valence [or H_2O or □] in the A site. All pyrochlore-supergroup minerals abstracted below have a cubic unit-cell, space group $Fd\overline{3}m$. The empirical formulae were calculated on the basis of 2 cations at the B site.

Oxycalcioroméite (IMA 2012-022), ideally, $Ca_2Sb^{5+}_2O_6O$, a member of roméite group, has been found at the Buca della Vena mine, Stazzema, Apuan Alps, Tuscany, Italy, where initially was reported as "stibiobetafite" (Orlandi and Dini, 2004). The mineral chemically corresponding to oxycalcioroméite with no crystallographic data was reported from Långban, Värmland, Sweden (Christy and Gatedal 2005). The new mineral occurs as euhedral octahedra, up to 0.1 mm, embedded in dolostone lenses at the zoned barite-pyrite-magnetite-hematite lens-shaped ore body at the contact between a metavolcanic-metasedimentary Triassic schists and dolostone and Lower Jurassic marbles. Associated minerals include cinnabar, derbylite, hematite, mica, pyrite, sphalerite, and tourmaline. The mineral crystallized from hydrothermal fluids related to Alpine metamorphism of greenschist facies. Oxycalcioroméite is reddish-brown, transparent with a vitreous to resinous luster and a pale-yellow streak. It is brittle, with an irregular fracture; D_{calc} = 5.393 g/cm^3. The mineral is optically isotropic with n_{calc} = 1.950 and does not fluoresce under UV light. IR spectrum collected in reflectance mode on a single crystal shows the band at 873 cm^{-1} (Sb-O vibrations). The bands of micro-Raman spectra are (cm^{-1}): 199 (lattice vibrations); 295 (O-Sb-O bending); 509, 666, 777 (Sb-O stretching). Both IR and Raman spectra have no peaks in the O-H bending and stretching regions. The average of 6 electron probe WDS analysis is [wt% (range)]: Sb_2O_5 75.86 (75.23–76.25) Sb_2O_5:Sb_2O_3 ratio 63.73:10.93 was calculated using crystal-chemical considerations, TiO_2 3.53 (2.18–4.33), SnO_2 0.28 (0.19–0.37), V_2O_3 0.68 (0.59–0.85), Al_2O_3 0.28 (0.26–0.31), PbO 0.68 (0.60–0.76), FeO 5.52 (5.32–5.86), MnO 0.13 (0.11–0.14), CaO 13.68 (13.34–13.82), Na_2O 0.83 (0.78–1.03), F 1.20 (0.67–1.59), $-O{=}F_2$ 0.51, total 100.96. All other elements with $Z > 8$ were below detection limit. The empirical formula is $(Ca_{1.07}Fe^{2+}_{0.34}Sb^{3+}_{0.33}Na_{0.12}Pb_{0.01}Mn_{0.01})_{\Sigma 1.88}(Sb^{5+}_{1.73}Ti_{0.19}V_{0.04}Al_{0.02}Sn_{0.01})_{\Sigma 1.99}(O_{6.68}F_{0.28})_{\Sigma 6.96}$. The strongest lines of the X-ray powder diffraction pattern [*d* Å (*I*%; *hkl*)] (s = strong, m = medium) are: 5.93 (m; 111), 3.105 (m; 311), 2.977 (s; 222), 2.576 (m; 400), 1.824 (s, 440), 1.556 (s, 622). The crystal structure of oxycalcioroméite has been solved by direct methods and refined to R_1 = 0.0114 for 114 independent $F_o > 4\sigma(F_o)$ reflections. The unit-cell parameters are a = 10.3042(7) Å, V = 1094.06 Å^3, Z = 8. The holotype specimen is deposited in the mineralogical collection of the Museo di Storia Naturale, Università di Pisa, Italy.

Oxyplumboroméite (IMA 2013-042), ideally $Pb_2Sb_2O_7$, is a mineral of the roméite group. It was described based on the examination of the specimens from the original L.J. Igelström monimolite collection from the Harstigen mine, Pajsberg, Värmland, Sweden, donated in the late 19th century to the Swedish Museum of Natural History, Stockholm, Sweden. The specimen chosen for the study (cat# g22779) fits best the original *monimolite* species description (Igelström 1865) and is now the type specimen for the oxyplumboroméite. It was earlier suggested (Atencio et al. 2010) that *monimolite* and *bindheimite* are identical to the possible new species oxyplumboromeite. It was proved by this study. Consequently the name *monimoite* is to be discredited as a valid mineral species name. Oxyplumboroméite occurs along with calcite and leucophoenicite in the fissures (up to 2 cm) in tephroite skarn. It forms aggregates up to 2 mm of yellow to brownish yellow rounded grains or imperfect octahedral crystals <0.4 mm. The mineral has a straw-yellow streak, is brittle, with a Mohs hardness of ~5; D_{calc} = 6.732 g/cm^3. The mineral is optically isotropic, n_{calc} = 2.061. The FTIR spectra collected in transmission mode in the spectral range 2000–5000 cm^{-1} show only 3613, 3571, 3547, 3527, and 3486 OH stretching bands. The average of 8 electron probe WDS analysis is [wt% (range)]: Sb_2O_5 48.69 (48.30–49.20), Al_2O_3 0.01 (0.00–0.03), Fe_2O_3 3.85 (3.74–4.05), SiO_2 0.00 (0–0.01), CaO 8.46 (8.39–8.58), MnO 1.06 (0.92–1.19), SrO 0.23 (0.18–0.31), BaO 0.01 (0.00–0.08), PbO 35.82 (35.33–36.55), Na_2O 0.24 (0.19–0.32), SO_3 0.07 (0.02–0.10), H_2O estimated as 0.05 using FTIR data, total 98.49. All other elements with $Z > 8$ were below detection limit. All detected Fe assigned to Fe^{3+} based on Mössbauer spectroscopy and all detected Mn to Mn^{2+} based on optical absorption spectrum while all Sb was assigned to Sb^{5+} by crystal-chemical considerations. The empirical formula is $(Pb_{0.92}Ca_{0.87}Mn_{0.09}Sr_{0.01}Na_{0.05})_{\Sigma 1.93}(Sb^{5+}_{1.73}Fe^{3+}_{0.27})_{\Sigma 2.00}[O_{6.64}(OH)_{0.03}]_{\Sigma 6.67}$. The strongest lines of the X-ray powder diffraction pattern [*d* Å (*I*%; *hkl*)] are: 2.992 (100; 222), 2.593 (32; 400), 1.833 (48; 440), 1.564 (38; 622), 1.498 (11; 444), 1.190 (12; 662). The crystal structure of was refined to R_1 = 3.02% for 160 unique reflections. The unit-cell parameters are a = 10.3783(6) Å, V = 1117.84 Å^3, Z = 8.

Comment: Bindheimite, defined by Dana (1868), was related to oxyplumboroméite with the data of Christy and Gatedal (2005), and on the basis of this Atencio et al. (2010) proposed it discreditation. Later on this name was restored to a questionable status by Christy and Atencio (2013), so awaits further study before the status can be changed.

Fluorcalcioroméite (IMA 2012-093), $(Ca,Na)_2Sb^{5+}_2(O,OH)_6F$, a new roméite-group mineral from Starlera mine, Ferrera, Hinterrhein district, Grischun, Switzerland. Chemical analyses corresponding to fluorcalcioroméite were previously reported from Fianel, Val Sterla and Starlera mines, Ferrera, Switzerland (Brugger et al. 1997; Brugger and Gieré 1999) and from Prašivá granitic pegmatites, Slovakia (Uher et al. 1998). Fluorcalcioroméite occurs in Mn-ore bodies up to 12 m thick (supposedly of synsedimentary-exhalative origin) generally hosted by dolomitic marbles, but also was found in direct contact with gneiss of the underlying basement. The intimately associated minerals are: braunite, hematite, calcite, quartz and, rarely, wallkilldellite. Fluorcalcioroméite forms yellow to orange translucent untwinned octahedra up to 1 mm with a vitreous to resinous luster and a white streak. The mineral does not fluoresce under UV light. Cleavage is not observed; fracture is conchoidal. It is brittle with Mohs hardness of ~5; D_{calc} = 5.113 g/cm^3. The mineral is optically isotropic, n_{calc} = 1.826. The wavenumbers of Raman spectrum peaks are (cm^{-1}): 827, 790 (weak) overtones; 518 (strong), 468 (weak, shoulder) Sb-O stretching; 302 (weak) O-Sb-O bending; 3630, 3686 stretching vibrations of OH groups. The average of 13 electron probe WDS analysis is [wt% (range)]: Na_2O 4.11 (3.75–4.44), CaO 15.41 (15.14–16.05), MnO 0.54 (0.43–0.67), CuO 0.01 (0–0.03), ZnO 0.01 (0–0.03), PbO 0.02 (0–0.10), Al_2O_3 0.10 (0.03–0.26), FeO 0.50 (0.41–1.11), Y_2O_3 0.07 (0.01–0.15), SiO_2 0.04 (0.02–0.12), TiO_2 0.01 (0–0.03), UO_2 0.01 (0–0.03), Sb_2O_5 76.18 (73.39–77.18), WO_3 0.78 (0.61–1.80), F 2.79 (2.40–3.07), H_2O 0.59 (by difference), $-O{=}F_2$ 1.17, total 100.00. The empirical formula is $(Ca_{1.16}Na_{0.56}\square_{0.22}Fe^{2+}_{0.03}Mn^{2+}_{0.03})_{\Sigma 2.00}(Sb^{5+}_{1.98}Al_{0.01}W_{0.01})_{\Sigma 2.00}O_6[F_{0.62}(OH)_{0.28}O_{0.06}\square_{0.04}]_{\Sigma 1.00}$. The strongest lines of the X-ray powder diffraction pattern [*d* Å (*I*%; *hkl*)] are: 5.934 (81; 111), 3.102 (20; 311), 2.969 (100; 222), 2.572 (6; 400), 1.979 (7; 333), 1.818 (8; 440), 1.551 (15; 622), 1.484 (5; 444). The crystal structure of was refined to an R_1 = 0.0106 for 123 unique reflections. The unit cell parameters are a = 10.2987(8) Å, V = 1092.3 Å^3, Z = 8. Type material is deposited in the collections of the Museo Regionale di Scienze Naturali, Sezione di Mineralogia, Petrografia e Geologia, Torino, Italy. Cotype specimens are deposited in the RRUFF project and in the Museu de Geociências, Instituto de Geociências, Universidade de São Paulo, Brazil.

Discussion: The general formula should be written as $(Ca,Na,\square)_2Sb^{5+}_2(O,OH)_6F$ based on charge balance.

Fluorcalciomicrolite (IMA 2012-036), $(Ca,Na,\square)_2Ta_2O_6F$, a new microlite-group, pyrochlore supergroup mineral described as an accessory mineral in the Volta Grande pegmatite, Nazareno, Minas Gerais, Brazil. The analyses corresponding to fluorcalciomicrolite have been reported earlier from Harding pegmatite, New Mexico, U.S.A. (Lumpkin et al. 1986) and then from various places in a number of papers but without a complete description. An intermediate member between fluorcalciomicrolite and fluornatromicrolite, close to $NaCaTa_2O_6F$, was studied by Andrade et al. (2011). In Volta Grande fluorcalciomicrolite is associated with microcline, albite, quartz, muscovite, spodumene, "lepidolite," cassiterite, tantalite-(Mn), monazite-(Ce), fluorite, "apatite," beryl, "garnet," epidote, magnetite, gahnite, zircon, "tourmaline," bityite, hydrokenomicrolite, and other microlite-group minerals under study. Fluorcalciomicrolite forms translucent colorless, adamantine to resinous, untwinned octahedral crystals up to 15 mm, occasionally modified by rhombododecahedral faces. It has a white streak, is brittle with a conchoidal fracture and no cleavage; Mohs hardness is 4–5; D_{calc} = 6.160 g/cm^3. The mineral is optically isotropic, n_{calc} = 1.992 and does not fluoresce under UV light. The main bands of the Raman spectrum (cm^{-1}) are: 168, 187 (not assigned); 292, 331, 417 (X–B–X bending modes); 505, 664 (B–X octahedral bond stretching); 792, 891 (not assigned). The FTIR spectrum shows a doublet at 3600–3581 cm^{-1} indicating the presence of OH groups. The average of 6 electron probe WDS analysis is [wt% (range)]: Na_2O 4.68 (4.41–4.83), CaO 11.24 (11.16–11.30), MnO 0.01(0–0.02), SrO 0.04 (0.01–0.06), BaO 0.02 (0–0.05), SnO_2 0.63 (0.50–0.80), UO_2 0.02 (0–0.05), Nb_2O_5 3.47 (3.14–3.81), Ta_2O_5 76.02 (74.61–77.43), F 2.80 (2.41–3.95), H_2O 0.48 (calc), $-O{=}F_2$ 1.18, total 98.23. The empirical formula is $(Ca_{1.07}Na_{0.81}\square_{0.12})_{\Sigma 2.00}(Ta_{1.84}Nb_{0.14}Sn_{0.02})_{\Sigma 2.00}[O_{5.93}(OH)_{0.07}]_{\Sigma 6.00}[F_{0.79}(OH)_{0.21}]_{\Sigma 1.0-0}$. The strongest lines of the X-ray powder diffraction pattern [*d* Å (*I*%; *hkl*)] are: 5.997 (59; 111), 3.138 (83; 311), 3.005 (100; 222), 2.602 (29; 400), 2.004 (23; 511), 1.841 (23; 440), 1.589 (25; 533), 1.504 (24; 444). The crystal structure solved by direct methods and refined to R_1 = 0.0132 for 147 unique reflections. The unit-cell parameters are a = 10.4191(6) Å , V = 1131.07 Å^3, Z = 8. Type material is deposited in the Museu de Geociências, Instituto de Geociências, Universidade de São Paulo, Brazil.

Hydroxycalciopyrochlore (IMA 2011-026), $(Ca,Na,U,\square)_2(Nb,Ti)_2O_6(OH)$, a new pyrochlore-group mineral, was described from the Maoniuping mine, Mianning County, Xichang prefecture, Sichuan Province, China. The mineral has previously been referred as betafite (Yang and Yan, 1991) and as *"calciobetafite"* (Zhang et al. 2003). Hydroxycalciopyrochlore was found in the rare-earth ore in an alkali feldspar granite and in aegirine-barite-calcite REE ore. Other associated minerals include celestine, albite, aegirine-augite, fluorite, parisite-(Ce), thorite, thorianite, zircon, galena, sphalerite, magnetite, and pyrite. The mineral forms mostly octahedral and less often dodecahedral or tetrahexahedral crystals up to 1 mm or their combinations. The crystal surface is covered by a thin yellow powdery coating. Hydroxycalciopyrochlore is translucent brownish-black, greenish-black, and black on fresh sections with a brown streak and an adamantine luster. It has a conchoidal fracture with no parting or cleavage. The Vickers microhardness (no load weight given) is 572 kg/mm^2 corresponding to 5.5 of the Mohs scale; D_{meas} = 5.10(3) g/cm^3; D_{calc} = 5.15 g/cm^3. Hydroxycalciopyrochlore does not dissolve in HCl and HNO_3, but dissolves in H_3PO_4. In transmitted light the mineral is brown; n_{calc} > 1.9. In reflected light hydroxycalciopyrochlore is gray. The reflectance spectra were measured between 400 and 700 nm with 20 nm interval. The R values for the selected wavelengths [R% (nm)] are: 18.6 (400), 12.9 (460), 12.7 (480), 13.3 (540), 11.6 (560), 11.2 (580), 11.7 (600), 11.3 (640), 12.2 (660), 14.5 (700). The main IR spectrum peaks (cm^{-1}) are: 933, 1143 (Nb-O octahedron vibrations); 1209 (Ca-O octahedron vibrations). The O-H stretching vibrations are hidden in the broad band centered at 3504 cm^{-1}. DTA analysis shows endothermic effect at 230 °C (dehydration) and exothermic peaks at 568 and 598 °C (recrystallization from the metamict state). The average of 10 electron probe analysis is [wt% (range)]: Nb_2O_5 36.36 (30.40–43.86), Ta_2O_5 1.78 (1.72–1.85), TiO_2 15.23 (12.10–18.06), Al_2O_3 0.15 (0.10–0.18), Ce_2O_3 2.02 (1.47–2.76), Y_2O_3 0.13 (0.09–0.18), UO_2 25.87 (22.13–27.95), ThO_2 0.26 (0.22–0.31), PbO 0.11 (0–0.24), CaO 9.89 (8.95–11.37), FeO 0.42 (0.32–0.60), MgO 0.08 (0.07–0.08), Na_2O 4.25 (3.04–4.85), F 0.38 (0.19–0.48), H_2O (by stoichiometry) 2.15, $–O=F_2$ 0.16, total 98.92. The empirical formula is $(Ca_{0.74}Na_{0.58}U_{0.40}Ce_{0.05}Fe_{0.02}\square_{0.21})_{\Sigma 2.00}(Nb_{1.15}Ti_{0.80}Ta_{0.03}Al_{0.01}Mg_{0.01})_{\Sigma 2.00}O_{6.02}[(OH)_{1.01}F_{0.09}]_{\Sigma 1.10}$. No diffraction lines could be obtained in the X-ray diffraction experiments due to metamict state of the mineral. After heating the sample twice at 900 and 1000 °C in the air the mineral was recrystallized. The strongest lines of the X-ray powder diffraction pattern [d Å (I%; hkl)] are: 2.966 (100; 222), 2.569 (18; 004), 1.814 (34; 044), 1.546 (21; 226), 1.480 (5; 444), 1.2815 (5; 008), 1.1776 (5; 266). The crystal structure solved by direct methods and refined to $R = 0.09$. The unit-cell parameters are $a = 10.381(4)$ Å, $V = 1118.7$ Å^3, $Z = 8$. Type material is deposited in the Geological Museum of China, Beijing, China. **D.B.**

Comment: The authors did not mention that the minerals with the composition match to that of hydroxycalciopyrochlore are common and were described in a number of papers from a various locations under the names pyrochlore, hydropyrochlore, betafite, and other names before the new pyrochlore supergroup nomenclature was applied. The one chosen to be a type (neotype) is far from end-member and is metamict.

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SCHLÜTERITE-(Y)*

M.A. Cooper, T.A. Husdal, N.A. Ball, Y.A. Abdu, and F.C. Hawthorne (2013) Schlüterite-(Y), ideally $(Y,REE)_2Al(Si_2O_7)(OH)_2F$, a new mineral species from the Stetind pegmatite, Tysfjord, Nordland, Norway: description and crystal structure. Mineralogical Magazine, 77(3), 353–366.

Schlüterite-(Y) (IMA 2012-015), ideally $(Y,REE)_2Al(Si_2O_7)(OH)_2F$, is a new silicate mineral from the Stetind pegmatite, Tysfjord, Nordland, Norway. The new mineral occurs in small cavities of fluorite masses associating with bastnäsite-(Ce), Y-fluorite, fluorthalénite-(Y), hematite, hundholmenite-(Y), kuliokite-(Y), perbøeite-(Ce), törnebohmite-(Ce), and vyuntspakhkite-(Y). Schlüterite-(Y) forms dense, fibrous, radiating aggregates up to 2 mm diverging to individual needle-like crystals in cavities that are up to 1 mm long and 0.025 thick. Crystals are acicular to bladed, flattened on {001} and elongated along [010] with dominant form {001}. Schlüterite-(Y) is pale pink transparent with a white streak and vitreous luster, is brittle with an irregular fracture, has no cleavage or parting and has a Mohs hardness of 5½–6. The density was not be measured due to the fibrous nature of the crystals; $D_{calc} = 1.82$ g/cm^3. The mineral does not fluoresce under short-wave ultraviolet light. Schlüterite-(Y) is non-pleochroic, optically biaxial (+), $\alpha = 1.755(5)$, $\beta = 1.760(5)$, $\gamma = 1.770(5)$, $2V_{obs} = 71.8(5)°$, and $2V_{calc} = 71°$; $X \wedge a = 83.1°$ (β obtuse), $Y // b$, $Z \wedge c = 50.3°$ (β acute). The main absorption bands of the IR spectrum (cm^{-1}) are: 3588 and 3453 (O-H stretching); 1071, 1046, 966, 915, and 860 (Si-O stretching). The absence of a band at ~1630 cm^{-1} indicates the absence of H_2O in the structure. The average of 6 electron probe WDS analyses gives [wt% (range)]: SiO_2 22.64 (22.22–23.25), Al_2O_3 9.45 (9.22–9.77), Y_2O_3 15.35 (13.99–16.00), La_2O_3 3.25 (2.97–3.43), Ce_2O_3 9.69 (8.45–11.97), Pr_2O_3 2.05 (1.92–2.38), Nd_2O_3 9.50 (8.82–10.50), Sm_2O_3 3.57 (3.33–3.83), Gd_2O_3 4.65 (4.41–4.86), Dy_2O_3 4.21 (4.06–4.38), Er_2O_3 2.31 (2.20–2.49), Yb_2O_3 1.86 (1.73–2.02), F 2.71 (1.95–2.93), H_2O (calc. by crystal-structure analysis) 3.78, $–O=F_2$ 1.14, sum 93.88 wt%. The low sum is due to the analysis having to be done on an unpolished surface of a very thin grain. The empirical formula $(Yr_{0.73}Ce_{0.32}Nd_{0.30}Gd_{0.14}Dy_{0.12}La_{0.11}Sm_{0.11}Pr_{0.07}Er_{0.06}Yb_{0.05})_{\Sigma 2.01}Al_{0.99}Si_{2.01}O_7(OH)_{2.24}F_{0.76}$ based on 10 anions with (OH)+F = 3 pfu. The strongest lines in the X-ray powder-diffraction pattern [d Å (I%; hkl)] are: 4.769 (100; 012), 2.972 (55; $\bar{2}14$), 3.289 (51; 112), 2.728 (49; $\bar{2}16$), 2.810 (37; 020), 3.013 (37; $\bar{1}16$), 4.507 (36; 004). Single-crystal X-ray diffraction data collected on a crystal of size 7 × 25 × 200 μm refined to $R_1 = 0.018$ for 1422 unique reflections shows schlüterite-(Y) is monoclinic, space group $P2_1/c$, $a = 7.0722(2)$, $b = 5.6198(1)$, $c = 21.4390(4)$ Å, $\beta = 122.7756(3)°$, $V = 716.43$ Å^3, $Z = 4$. The structure of schlüterite-(Y) consists of $Al(OH)_4O_2$ octahedra that share (OH)-(OH) edges to form $[M\phi_4]$ decorated by (Si_2O_7) groups that bridge O vertices of neighbouring octahedra in a staggered fashion on either side of the chain. These $[Al(OH)_2(Si_2O_7)]$ chains extend parallel to **b**, and are linked into a framework by 8- and 9-coordinated (Y,REE) cations both directly and through (Y,REE)-F-(Y,REE) linkages, and through H···F hydrogen bonds. The mineral is named in honor of Jochen Schlüter (b.1955), curator and director of the Mineralogical Museum of the University of Hamburg since 1988. The holotype specimen of schlüterite-(Y) have been deposited in the mineral collection of the Department of Natural History, Royal Ontario Museum, Toronto. Cotype specimens were deposited in in the collections of the Natural History Museum, Oslo, Norway. **O.C.G.**

ŠVENEKITE*

P. Ondruš, R. Skála, J. Plášil, J. Sejkora, F. Veselovský, J. Čejka, A. Kallistová, J. Hloušek, K. Fejfarová, R. Škoda, M. Dušek, A. Gabašová, V. Machovič, and L. Lapčák (2013) Švenekite, $Ca[AsO_2(OH)_2]_2$, a new mineral from Jáchymov, Czech Republic. Mineralogical Magazine, 77(6), 2711–2724.

Švenekite (IMA 1999-007), ideally $Ca[AsO_2(OH)_2]_2$, is a new supergene arsenate mineral occurring in the Geschieber vein, Jáchymov ore district, Western Bohemia, Czech Republic. The mineral was first described as an unnamed mineral phase from the Jáchymov ore district under the acronym "CAS" (Ondruš et al. 1997), and its occurrence was shortly described by Ondruš et al. (2003). Švenekite occurs as a supergene mineral that grows directly on granite rocks isolated from other arsenates, which are common in Jáchymov. The mineral crystallized from concentrated strongly acidic solution with a strong circulation, which carried arsenic acid produced by decomposition of native arsenic or arsenides common in the Geschieber vein. Švenekite forms clear transparent coatings composed of indistinct radiating to rosette-shaped aggregates up to 3 mm across with a glassy luster, but also white botryoidal crusts with a matte or lustrous surface. The rosettes are composed of thin lens- to blade-shaped crystals, usually 100–150 μm in length. The new mineral is transparent to translucent, has a white streak, vitreous luster, is brittle with an uneven fracture and has very good cleavage on {010}. The Mohs hardness is ~2; D_{meas} = 3.16(1), D_{calc} = 3.26 g/cm^3. Some crystals were found to display faint striations and/or minute hollows. Švenekite does not fluoresce under ultraviolet light. It is biaxial, α' = 1.602(2), γ' = 1.658(2), and is non-pleochroic. The optical sign and main refractive indexes could not be measured; n_{calc} =1.62. The main absorption bands of Raman spectrum (cm^{-1}) are: 3368, 2917, and 2385 [ν(O-H) stretching vibrations of hydrogen-bonded hydroxyl ions], 929, 901, 871, and 840 (ν_1 symmetric As-O vibrations of the [$(AsO_2(OH)_2$] groups), 753 and 726 (ν_3 antisymmetric and ν_1 symmetric As-OH stretching vibrations), 541 and 498 (δ As-OH out-of-plane bending vibrations), 417, 393, and 358 [ν_4(δ) O-As-O bending vibrations], 330 and 289 [ν_2(δ) O-As-O bending vibrations], 268 and 223 [ν(OH-O) vibrations], 172 (lattice modes). The main absorption bands of IR spectrum (cm^{-1}) are: 3400, 3371, 2965, 2930, and 2386 [ν(O-H) stretching vibrations of hydrogen-bonded hydroxyl ions]; 913, 882, and 807 (ν_3 antisymmetric As-O vibrations of the [$(AsO_2(OH)_2$] groups); 745 and 711 (ν_3 antisymmetric and ν_1 symmetric As-OH stretching vibrations); 600, 536, and 498 (δ As-OH out-of-plane bending vibrations). The average of 10 electron probe WDS analyses on the holotype specimen is [wt% (range)]: CaO 17.51 (17.03–17.87), MgO 0.12 (0.00–0.19), As_2O_5 70.56 (69.21–71.64), P_2O_5 0.64 (0.39–0.85), SO_3 0.18 (0.05–0.91), H_2O (calc. by stoichiometry) 11.22 (11.01–11.38), total 100.23. The empirical formula $(Ca_{1.00}Mg_{0.01})_{\Sigma 1.01}[AsO_2(OH)_2]_{1.96}[PO_2(OH)_2]_{0.03}(SO_4)_{0.01}$ based on As+P+S = 2 apfu. The average of 5 electron probe WDS analyses on a cotype specimen is [wt% (range)]: Na_2O 0.12 (0.08–0.15), CaO 17.26 (16.96–17.43), MgO 0.17 (0.14–0.25), SiO_2 0.10 (0.04–0.22), As_2O_5 71.27 (70.51–72.37), P_2O_5 0.08 (0.04–0.12), SO_3 0.15 (0.07–0.22), H_2O (by stoichiometry) 11.19 (11.08–11.36) total 100.35. The empirical formula $(Ca_{0.99}Mg_{0.01}Na_{0.01})_{\Sigma 1.01}[AsO_2(OH)_2]_{1.99}[PO_2(OH)_2]_{0.01}(SiO_4)_{0.01}(SO_4)_{0.01}$ based on As+P+Si+S = 2 apfu. The strongest lines in the X-ray powder-diffraction pattern [*d* Å (*I*%; *hkl*)] are: 3.968 (33; $2\bar{1}0$), 3.766 (35; $2\bar{1}\bar{1}$), 3.697 (49; 101), 3.554 (100; 020), 3.259 (33; $2\bar{2}0$), and 3.097 (49; $1\bar{2}1$). The unit-cell parameters refined from powder-diffraction data are: a = 8.5482(3), b = 7.6945(3), c = 5.7180(2) Å, α = 92.602(2)°, β = 109.867(2)°, γ = 109.910(2)°, and V = 327.01 Å^3. Single-crystal X-ray diffraction data collected on a crystal of size 0.13 × 0.04 × 0.02 mm refined to R_1 = 0.0250 for 1309 unique $I \geq 3\sigma(I)$ reflections. Švenekite is triclinic, space group $P\bar{1}$, with a = 8.5606(5), b = 7.6926(6), c = 5.7206(4) Å, α = 92.605(6), β = 109.9002(6), γ = 109.9017(6)°, V = 327.48 Å^3, Z = 2. The structure of svenekite consists of sheets of corner-sharing CaO_8 polyhedra and $AsO_2(OH)_2$ groups, stacked parallel to (001) and where adjacent sheets are linked by hydrogen bonds. The mineral is named in honor of Jaroslav Švenek, the former curator of the mineralogical collection of the National Museum in Prague, Czech Republic. The holotype specimen of švenekite has been deposited in the mineral collection of the National Museum in Prague, Czech Republic. **O.C.G.**

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TANGDANITE*

M. Zhesheng, L. Guowu, N.V. Chukanov, G. Poirier, and S. Nicheng (2014) Tangdanite, a new mineral species from the Yunnan Province, China and the discreditation of 'clinotyrolite'. Mineralogical Magazine, 78(3), 559–569.

Tangdanite (IMA 2011-096), ideally $Ca_2Cu_9(AsO_4)_4(SO_4)_{0.5}(OH)_9 \cdot 9H_2O$, is a new mineral found in the oxidized zone (gossan) of an As-bearing Cu sulfide deposit in the Tangdan and Nanniping mines southeast Dongchuan copper mining district, Dongchuan County, Kunming City Prefecture, Yunnan Province, China. The mineral was previously described (Ma et al. 1980) under the name "clinotyrolite," but was not submitted to nor recognized by the IMA. Further study established that chemically and structurally the new mineral is different from tyrolite. The name "clinotyrolite" was discredited, and the new mineral tangdanite was approved. The mineral was named after its locality at the Tangdan mine. It was found in the Cu ore veins hosted by the Luoxue dolomite of the Kunyang Group. Tangdanite is associated with chalcopyrite, bornite, chalcocite, covellite, tennantite, enargite, cuprite, and with secondary malachite, azurite, copper, and brochantite. The mineral is emerald green to dark green with a light-green streak and a pearly to silky luster. Flaky crystals of tangdanite of about 0.5 mm form radiating or foliated aggregates up to 3 mm in size. The crystals are flattened parallel to (100) and elongated along [001]. Tangdanite has {100}, {010}, {001}, and {013} forms, a tabular habit and no twinning. The new mineral has a perfect cleavage on {100}, it is sectile with no any parting. The microhardness VHN_{50} = 42.8 (42.0–43.6) kg/mm^2 corresponding to 2–2½ of Mohs scale; D_{obs} = 3.22, D_{calc} = 3.32 g/cm^3. No fluorescence was observed in short- or long-wave UV light. Tangdanite is optically biaxial (–), α = 1.666, β = 1.686, and γ = 1.694; $2V_{obs}$ = 65–66°, $2V_{calc}$ = 64°. The orientation is $Y = b$; $Z \wedge a$ = 3–4°, $X \wedge c$ = 7–8°. The mineral is weakly pleochroic, with Z = medium green and Y = yellow green. The bands on IR spectrum are (cm^{-1}): 402, 475, 671, 810, 850, 940, 1029, 1080, 1121, 1604, 1640, 300, 3340, and

3470 cm^{-1}. The average of 10 electron probe WDS analyses is (wt%, range): CaO 7.29 (7.13–7.46), CuO 45.71 (45.06–47.53), As_2O_5 29.82 (29.03–30.88), SO_3 1.60 (1.17–1.86), H_2O 15.58 (by difference), total 100.00. The formula calculated on the basis of 36 oxygen apfu is: $Ca_{2.05}Cu_{9.08}(As_{1.03}O_4)_4(S_{0.63}O_4)_{0.5}(OH)_9 \cdot 9H_{2.04}O$. The strongest lines of the X-ray powder diffraction patterns [*d* Å (*I*%; *hkl*)] are: 5.263 (54; $\overline{2}02$), 4.782 (100; $\overline{3}11$), 4.333 (71; 602), 3.949 (47; 802), 2.976 (46; $\overline{1}\,\overline{5}\,11$). The crystal structure of tangdanite was solved by direct methods and refined to R_1 = 11.43%. The mineral is monoclinic, *C*2/*c*, *a* = 54.490(9), *b* = 5.5685(9), *c* = 10.4690(17) Å, β = 96.294(3)°, *V* = 3157.4 Å^3, and *Z* = 4. The crystal structure of tangdanite is based on complex slabs consisting of two types of layers. In layer A, $[AsO_4]$ tetrahedra share corners with $[CuO_5(H_2O)]$ octahedra, while layer B consists of chains of edge-sharing $[CuO_3(OH)_3]$ octahedra running along [010]. There are Ca atoms on the outer sides of slabs of the A and B layers. (H_2O) and (SO_4) isolated tetrahedra are located in the interlayer space. Holotype material is deposited in the collections of the Geological Museum of China, Beijing, China, and in the Canadian Museum of Nature, Gatineau, Quebec, Canada. **Yu.U.**

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VANADOALLANITE-(LA)*

M. Nagashima, D. Nishio-Hamane, N. Tomita, T. Minakawa, and S. Inaba (2013) Vanadoallanite-(La): a new epidote-supergroup mineral from Ise, Mie Prefecture, Japan. Mineralogical Magazine, 77(6), 2739–2752.

Vanadoallanite-(La) (IMA 2012-095), ideally $CaLaV^{3+}AlFe^{2+}(SiO_4)(Si_2O_7)O(OH)$ is a new mineral found in the stratiform ferromanganese deposit from the Shobu area, Ise City, Mie Prefecture, Japan. The new mineral occurs in a tephroite vein closely associating with rhodochrosite. Other surrounding minerals include magnetite, hematite, caryopilite, monazite-(La), chalcopyrite, pentlandite, heazlewoodite, bementite, and iseite. Vanadoallanite-(La) usually occurs as aggregates of euhedral to subhedral prismatic crystals up to 300 μm elongated parallel to [010]. Crystals are dark brown, vitreous, are brittle and have imperfect cleavage on {001}. The density was not measured; D_{calc} = 4.15 g/cm^3. The average of 3 electron probe WDS analyses is [wt% (range)]: SiO_2 29.97 (29.84–30.05), TiO_2 1.01 (0.83–1.32), Al_2O_3 7.64 (7.21–8.06), Cr_2O_3 0.16 (0.10–0.21), V_2O_3 7.64 (6.75–8.38), FeO 6.94 (6.41–7.38) and Fe_2O_3 5.47 (4.73–5.73) (by charge balance), MnO 8.03 (7.59–8.77), NiO 0.05 (0.00–0.07), MgO 0.39 (0.18–0.67), CaO 6.97 (6.42–7.55), SrO 0.16 (0.10–0.25), Y_2O_3 0.02 (0.01–0.03), La_2O_3 12.14 (11.04–13.16), Ce_2O_3 3.75 (3.62–3.86), Pr_2O_3 1.86 (1.68–2.11), Nd_2O_3 4.94 (4.75–5.14), Er_2O_3 0.09 (0.06–0.11), F 0.07 (0.05–0.08), $-O{=}F_2$ 0.03 (–0.02–0.04), H_2O (by difference) 2.75 (2.30–3.28), total 97.25. The empirical formula $(Ca_{0.75}Sr_{0.01}La_{0.45}Ce_{0.14}Pr_{0.07}Nd_{0.18}Mn^{2+}_{0.38})_{\Sigma 1.98}(Mn^{2+}_{0.31}Mg_{0.06}Fe_{1.00}V^{3+}_{0.63}Cr_{0.01}Al_{0.91}Ti_{0.08})_{\Sigma 3.00}Si_{3.02}O_{12}(OH)_{0.98}F_{0.02}$ based on 8 cations (excluding H) pfu. Powder X-ray analysis could not be done due to paucity of material; the strongest lines in the calculated X-ray powder-diffraction pattern [d_{calc} Å (I_{calc}%; *hkl*)] are: 2.910 (100; $11\overline{3}$), 2.621 (53; $31\overline{1}$), 3.521 (49; $21\overline{1}$), 2.883 (38; 020), 2.716 (37; 120), 2.715 (36; 013). Single-crystal X-ray diffraction data collected on a crystal of size 0.08 × 0.06 × 0.02 mm refined to R_1 = 0.0296 for 1920 unique reflections shows vanadoallanite-(La) is monoclinic, space group $P2_1/m$, with *a* = 8.8985(2), *b* = 5.7650(1), *c* = 10.1185(2) Å, β = 114.120(1)°, and *V* = 473.76 Å^3. Vanadoallanite-(La) is an epidote-supergroup mineral; its structure is based on a chain of edge-sharing *M*2 octahedra and a central chain of *M*1 octahedra with *M*3 octahedra attached on alternate sides along its length. The chains of octahedra run parallel to the *b* axis and are linked by SiO_4 and Si_2O_7 groups. The mineral is named from the root-name vanadoallanite and its site occupancy in *M*3 and *A*1. The type specimen is deposited in the National Museum of Nature and Science, Tokyo, Japan. **O.C.G.**