New Mineral Names*,†

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ALFREDOPETROVITE*

A.R. Kampf, S.J. Mills, B.P. Nash, B. Thorne and G. Favreau (2016) Alfredopetrovite, a new selenite mineral from the El Dragón mine, Bolivia. European Journal of Mineralogy, 28(2), 479–484.

Alfredopetrovite (IMA 2015-026), ideally $Al_2(Se^{4+}O_3)_3 \cdot 6H_2O$, is a new selenite mineral from the El Dragón mine, Antonio Quijarro Province, Potosí Department, Bolivia. The mine exploited a telethermal deposit consisting of a single selenide vein hosted by sandstones and shales. The main primary mineral is a Co-rich krut'aite–penroseite. Clausthalite, petrovicite, watkinsonite, eldragónite, and grundmannite were crystallized from later solutions. Alfredopetrovite is a secondary mineral and occurs in vugs in a krut'aite-penroseite-dolomite-goethite matrix. Other closely associated secondary minerals are: ahlfeldite, allophane, calcite, chalcomenite, favreauite, felsőbányaite, malachite, and molybdomenite. Alfredopetrovite forms colorless to blue (transmit chalcomenite color) drusy/scaly coatings and compact balls up to 0.5 mm. Individual crystals are up to ~0.1 mm. Crystals are transparent with a white streak and a vitreous luster. The mineral is brittle with a smooth curved fracture and no apparent cleavage. Mohs hardness is 2½. The density was not measured because crystal fragments are virtually invisible in density liquids; D_{calc} = 2.504 g/cm³. Alfredopetrovite is optically uniaxial (+), ω = 1.554(2), and ε = 1.566(2) (white light); non-pleochroic. The average of 3 electron probe WDS analyses [wt% (range)/wt% normalized to 100%] is: CuO 1.27 (1.04–1.46)/1.09, CoO 0.12 (0.10–0.15)/0.10, NiO 0.51 (0.35–0.68)/0.44, Al_2O_3 20.99 (20.41–22.04)/18.12, SeO_2 69.63 (68.83–70.36)/60.12, H_2O (by structure analysis) 23.30/20.12, total 115.82/99.99. The high total is due to dehydration in vacuum and under electron beam. The empirical formula based on 15 O apfu is $Al_{1.94}Cu_{0.07}Ni_{0.03}Co_{0.01}Se_{2.95}O_{15}H_{12.16}$. IR data was not obtained. The strongest lines in the X-ray powder diffraction pattern are [d Å (I; hkl)]: 7.63 (55; 100), 6.22 (55; 101), 5.37 (26; 002), 4.398 (40; 110,102), 3.404 (100; 112), 2.783 (50; 211), 2.606 (22; 203), 1.661 (26; 410,322,314,116). The unit-cell parameters refined from the powder data are: a = 8.7978(14), c = 10.7184(18) Å, V = 718.5 Å³. Alfredopetrovite is hexagonal, space group $P\bar{6}2c$. The single crystal unit-cell parameters are: a = 8.818(3), c = 10.721(2) Å, V = 722.0 Å³, and Z = 2. The crystal structure was refined to R_1 = 0.0268 for 240 observed [$F_o > 4\sigma F_o$] reflections. The structure is comprised of fairly regular AlO_6 octahedra and $Se^{4+}O_3$ triangular pyramids. Three $Se^{4+}O_3$ pyramids link two adjacent AlO_6 octahedra forming a $[Al(H_2O)_3]_2(Se^{4+}O_3)_3$ unit. These units are bonded only via hydrogen bonds yielding a structure with relatively large channels along [001]. The configuration of the cluster is similar to that of the distinctive unit in the NASICON (sodium super-ionic conductor) structure, commonly referred as a lantern unit. The mineral is named in honor of Alfredo Petrov (b. 1955), geologist/mineralogist and an avid mineral collector for his contributions to mineralogy and geology of Bolivia and as well for his contributions to mineral collector's community as an author of a numerous publications and an active manager of http://www.mindat.org. Four cotypes (one of those is also cotype for favreauite) are deposited in the Natural History Museum of Los Angeles County, Los Angeles, U.S.A. One cotype specimen (it is also a cotype of favreauite) is housed in the Museum Victoria, Australia. **D.B.**

BUSSYITE-(Y)*

J.D. Grice, R. Rowe and G. Poirier (2015) Bussyite-(Y), a new beryllium silicate mineral species from Mont Saint-Hilaire, Quebec. Canadian Mineralogist, 53(2), 235–248.

Bussyite-(Y) (IMA 2014-060), $(Y,REE,Ca)_3(Na,Ca)_6MnSi_9Be_5$ $(O,OH,F)_{34}$, is a new mineral species from the Poudrette quarry (level 7), Mont Saint-Hilaire, Quebec, Canada. It occurs in a small alkaline pegmatite as embedded dark brown prismatic crystals inside massive white analcime. It differs from associated aegirine prisms by rectangular cross sections. Other associated minerals include microcline, sérandite, calcite, cappelenite-(Y), catapleiite, charmarite-2H and -3T, fluorite, helvine, kupletskite, perraultite, and tainiolite. The bussyite-(Y) crystals are prismatic to bladed, blocky, sometimes radiating, and reach up to 3 mm. The mineral is transparent to translucent, with a white streak and vitreous luster. It is brittle with a perfect {101} cleavage and splintery fracture; Mohs hardness is ~4. The density was not measured due to the small grain size; D_{calc} = 3.11 g/cm³. Bussyite-(Y) is non-pleochroic, optically biaxial (–) with α = 1.583(2), β = 1.593(2), γ = 1.600(2), $2V_{meas}$ = 68(2)°, $2V_{calc}$ = 79°; Z ^ **c** = 33° (β obtuse), Y = **b**, and X = [101]. Dispersion was not observed. Fine lamellar twinning, parallel to the elongation, was noted in some crystals. On the IR spectrum of bussyite-(Y) a low broad peak at 3500–2500 cm⁻¹ and 4 minor peaks in the 2500–2000 cm⁻¹ range are assigned to OH stretching vibrations. The large broad peak centered at 967 cm⁻¹ assigned to [SiO_4] and [BeO_4] stretching modes with shoulders at 1008 and 1036 cm⁻¹ likely due to the shorter bonds between Be and Si and OH and F. The moderate sharper peaks at 859, 705, and 647 cm⁻¹ are assigned to the [SiO_4] and [BeO_4] bending modes. The average of 3 electron probe WDS analysis [wt% (ranges)] is: Na_2O 8.21 (8.07–8.43), K_2O 0.08 (0.50–0.10), BeO 9.75 (by structure refinement), CaO 5.25 (5.16–5.36), MnO 2.93 (2.57–3.20), BaO 0.03 (0–0.06), FeO 0.40 (0.25–0.60), Al_2O_3 0.29 (0.21–0.34), Y_2O_3 7.58 (7.37–7.79), La_2O_3 0.48 (0.40–0.60), Ce_2O_3 2.66 (2.37–3.09), Pr_2O_3

0.55 (0.40–0.64), Nd_2O_3 2.85 (2.81–2.93), Sm_2O_3 1.45 (1.23–1.58), Eu_2O_3 0.013 (0.12–0.17), Gd_2O_3 1.97 (1.57–2.21), Tb_2O_3 0.31 (0.25–0.40), Dy_2O_3 2.20 (1.81–2.46), Ho_2O_3 0.39 (0.33–0.48), Er_2O_3 0.93 (0.86–1.07), Tm_2O_3 0.16 (0.12–0.20), Yb_2O_3 0.46 (0.36–0.60), Lu_2O_3 0.01 (0.01–0.01), Nb_2O_5 0.20 (0.15–0.25), SiO_2 39.62 (38.96–40.03), ThO_2 2.21 (1.90–2.43), F 3.49 (3.39–3.66), Cl 0.03 (0.02–0.03), H_2O 5.10 (by structure refinement), $-O=(F+Cl)_2$ 1.48, total 98.15. The empirical formula based on the 34 anions pfu is: $(Y_{0.87}Nd_{0.22}Ce_{0.21}Dy_{0.15}Gd_{0.14}Sm_{0.11}Er_{0.06}Pr_{0.04}La_{0.04}Yb_{0.03}$ $Ho_{0.03}Tb_{0.02}Tm_{0.01}Eu_{0.01}Ca_{0.79}Th_{0.11})_{\Sigma2.84}(Na_{3.45}Ca_{0.43}K_{0.02})_{\Sigma3.90}(Mn_{0.54}Fe_{0.07})_{\Sigma0.61}$ $(Si_{8.59}Be_{5.08}Al_{0.07})_{\Sigma13.74}(O_{24.11}OH_{5.89})_{\Sigma30}(F_{2.39}OH_{1.60}Cl_{0.01})_{\Sigma4}$. The strongest lines of the powder X-ray diffraction pattern [d Å (I%; hkl)] are: 8.049 ($\bar{1}$00; 111), 6.924 (21; 020), 3.529 (38; 311), 3.435 (21; $\bar{1}$33), 3.155 (23; $\bar{1}$15), 2.940 (35; $\bar{3}$31), 2.840 (50; 331), 2.736 (30; 006), 2.651 (38; $\bar{1}$35), 2.629 (30; 402). The unit-cell parameters of the monoclinic cell (space group $C2$) refined from X-ray powder-diffraction data are: $a = 11.545(2)$, $b = 13.840(2)$, $c = 16.504(4)$ Å, $\beta = 95.87(2)°$, $V = 2623.1$ Å^3; $Z = 4$. The single crystal unit-cell parameters are: $a = 11.600(3)$, $b = 13.856(3)$, $c = 16.516(4)$ Å, $\beta = 95.84(1)°$, $V = 2641$ Å^3. The structure was refined to $R_1 = 0.035$ for 6531 unique, observed reflections. Bussyite-(Y) has a layered structure consisting of two chemically distinct layers parallel to ($\bar{2}$01): (1) a layer of [(Si,Be)O$_4$] tetrahedra and (2) a large cation Y-,Ca-,Mn-,Na-(O,F) polyhedral layer. Layers are cross-linked through shared O and F atoms. The polyhedra of the layer (2) are in two chains: higher bond-valence cations Y, Ca, and Mn form one polyhedral chain that is cross-linked to the chain of Na polyhedra. There are a number of holes that contain the H atoms. The tetrahedral layer is made up of a series of cross-linked 4-, 5-, and 8-connected rings. The 8 Na sites of the layer (2) ideally hold 6 cations. The discrepancy with electron probe data [$(Na_{3.45}Ca_{0.43}K_{0.02})_{\Sigma3.90}$] is explained by possible loss of Na under the electron beam which also could be a reason for a low wt% total. The structure of bussyite-(Y) is topologically similar to that of bussyite-(Ce) but differs in details. The H atoms are much more abundant in bussyite-(Ce) as [H$_2$O] groups at Na vacant sites while there are no [H$_2$O] groups in bussyite-(Y) and OH groups are at O and F sites coordinated to Be. The amount of H in both minerals is approximately equal in weight percent. The mineral was named as Y analog of bussyite-(Ce). The root name honors the French chemist and pharmacist Antoine Alexandre Brutus Bussy (1794–1882) who researched the preparation of magnesium and isolating the element beryllium. The holotype specimen is housed in the Canadian Museum of Nature, Ottawa, Ontario, Canada. **D.B.**

COLINOWENSITE*

B. Rieck, H. Pristacz and G. Giester (2015) Colinowensite, BaCuSi$_2$O$_6$, a new mineral from the Kalahari Manganese Field, South Africa and new data on wesselsite, SrCuSi$_4$O$_{10}$. Mineralogical Magazine, 79(7), 1769–1778.

Colinowensite (IMA 2012-060), ideally BaCuSi$_2$O$_6$, is new mineral species from the central-eastern ore body of the Wessels mine, Kalahari Manganese Field, Northern Cape Province, South Africa. It was found in 2 specimens which both contain a subset of typical paragenesis of Ba-, Sr-, and Cu-bearing silicates effenbergerite-wesselsite, lavinskyite, scottyite, and diegogattaite, in close association with pectolite, quartz, aegirine, and richterite, minerals of the garnet group and a number of manganese and iron oxides with a dominance of hausmannite and hematite. Sugilite, which is generally found in the same paragenesis, is almost completely absent on these specimens. Colinowensite forms purple to dark blue (when thicker) vitreous subhedral crystals up to $100 \times 100 \times 50$ μm with a purple streak. The crystal forms {100} and {110} are observed while {001} is always present as a cleavage planes. No fluorescence is observed under UV radiation. The mineral is brittle, with uneven fracture, and the estimated Mohs hardness is ~4. The density by micropicnometry is 4.20(5); D_{calc} = 4.236 g/cm^3. Colinowensite is not soluble in acids except HF. It shows

very intense absorption in the range 450–620 nm, rendering the mineral almost opaque. Optical measurements in this range lack any confidence. They are feasible below and above this range, albeit with a relatively large estimated error. Colinowensite is uniaxial (–), with $\omega = 1.740(20)$, $\varepsilon = 1.735(20)$ (420 nm) and $\omega = 1.745(20)$, $\varepsilon = 1.730(20)$ (650 nm). It is very strongly pleochroic from purple along the **c** axis to blue in a perpendicular direction. The average of electron probe WDS analysis of 5 fragments (4 spots each) [wt% (range)] is: CuO 22.53 (22.09–22.98), BaO 43.43 (42.58–44.29), SiO$_2$ 34.04 (33.71–34.37), total 100.00. No other elements detectable by electron probe were found. The empirical formulae based on 6 O apfu is Ba$_{1.00}$Cu$_{1.00}$Si$_{2.00}$O$_6$. No IR data was obtained. The strongest lines of the powder X-ray diffraction pattern [d Å (I%; hkl)] are: 5.577 (31; 004), 4.997 (30; 020), 4.560 (31; 022), 3.533 (70; 220), 2.985 (100; 224), 2.499 (57; 040), 2.280 (23; 044), 1.767 (19; 440). The parameters of the tetragonal unit cell refined from the powder data are $a = 9.9762(4)$, $c = 22.3200(9)$ Å, $V = 2221.4$ Å^3. The single crystal unit-cell parameters are $a = 9.967(1)$, $c = 22.290(2)$ Å, $V = 2214.4$ Å^3, $Z = 16$, space group $I4_1/acd$. The crystal structure solved and refined to $R_1 = 0.021$ based on 1379 unique F_o $> 4\sigma(F_o)$ reflections. Colinowensite is a cyclosilicate with a 4-membered single rings [Si$_4$O$_{12}$]$^{8-}$, arranged in sheets parallel to (001). CuO$_4$ squares sharing corners with four neighboring silicate rings within a sheet. Ba^{2+} cations are bonded to 10 O atoms in irregular coordination. Colinowensite is the natural analog of the well-studied synthetic pigment referred to as Chinese or Han purple, which is found on artifacts from ancient and imperial China. The mineral was named for the mineral collector and finder of the new species, Colin R. Owens (b. 1937), of Somerset West, South Africa. Type material is deposited in the collection of the Institut für Mineralogie und Kristallographie, University of Vienna, Austria. The X-ray structure refinement of single crystals taken from the newly collected wesselsite is also provided in the paper. Wesselsite belongs to the gillespite type of compounds with general formula ABSi$_4$O$_{10}$ (A = Ca, Sr, Ba; B = Cr, Fe, Cu). The crystal structure is characterized by 4-membered rings of SiO$_4$ tetrahedra, [Si$_4$O$_{10}$]$^{4-}$, which are connected into infinite sheets parallel to (001). Cu atoms in nearly planar square coordination are attached on both sides of the sheets. Adjacent layers are linked together by the Sr atoms in distorted square-antiprismatic coordination. Based on microprobe and refined site occupancy data, the composition of studied wesselsite is close to Sr$_{0.9}$Ba$_{0.1}$CuSi$_4$O$_{10}$. The parameters of the tetragonal unit-cell are: $a = 7.374(1)$, $c = 15.636(2)$ Å, $V = 850.2$ Å^3, space group $P4/ncc$, $Z = 4$. The complete solid solution has been observed for the synthetic compounds and in wide range between natural wesselsite and effenbergerite. Contrary to this, no significant Ba-Sr substitution was found in colinowensite and scottyite and no isotypic strontium copper silicates are known. **D.B.**

ESQUIREITE*

A.R. Kampf, R.M. Housley, G.E. Dunning and R.E. Walstrom (2015) Esquireite, BaSi$_6$O$_{13}$·7H$_2$O, a new layer silicate from the barium silicate deposits of California. Canadian Mineralogist, 53(1), 3–12.

The new mineral esquireite (IMA 2014-066), ideally BaSi$_6$O$_{13}$·7H$_2$O was found at the Esquire #1 claim along Rush Creek, eastern Fresno County, California, U.S.A. (36°58′25″N 119°15′01″W), and in Ba-silicate lens on the NW slope of Trumbull Peak, Mariposa County, California, U.S.A. (37°41′31″N 119°51′51″W). This is the 18th new species to be described from these localities. Esquireite forms as the result of contact metamorphism of Ba-rich sediments on sanbornite cleavage surfaces and along fractures transverse to cleavages. It is also often found in intimate association with or embedded in white, massive witherite and/or opal. All three minerals appear to be low-temperature hydrothermal alteration products of sanbornite, with opal postdating esquireite. At the Esquire #1 claim esquireite is also associated with cerchiaraite-(Al), kampfite, macdonaldite, pyrrhotite, quartz, titantaramellite, and traskite. At Trumbull Peak, it is also associated with fencooperite, gillespite, macdonaldite,

quartz, and titantaramellite. Esquireite occurs as colorless transparent rectangular blades, elongated and striated parallel to [010] and flattened on {001}. Twinning is common on {001}. The streak is white, the luster is vitreous to pearly. The mineral shows no fluorescence under UV radiation. It is brittle with irregular fracture and Mohs hardness is ~2. Two cleavages are observed: perfect on {001} and fair on {100}. The density (by flotation in an aqueous solution of sodium polytungstate) is D_{meas} = 2.18(2) g/cm^3; D_{calc} = 2.237 g/cm^3. The mineral is insoluble and unreactive in concentrated HCl, H_2SO_4, HNO_3, and NaOH. Esquireite is optically biaxial (+), with α = 1.477, β = 1.481, γ_{calc} = 1.492 (white light), $2V_{meas}$ = 63.8(6)°; Y = $\mathbf{b}$, $Z \wedge \mathbf{c} \approx 22°$. No dispersion or pleochroism was observed. The average of the WDS electron probe analyses (wt% for 4 points from Esquire #1 claim samples and 2 from Trumbull Peak crystals) along with the ranges (in parentheses) are: BaO 25.65 (25.06–26.20), SiO_2 63.60 (62.88–64.53), H_2O (based upon the crystal structure) 22.41, total 111.66 (due to dehydration under vacuum). The data normalized to a total of 100% are BaO 22.97, SiO_2 56.96, H_2O 20.07. The empirical formula (based on 20 O apfu) is $Ba_{0.95}Si_{6.00}O_{20}H_{14.10}$. The strongest lines in the X-ray powder diffraction pattern obtained in powdered sample by Gandolfi-type motion [d Å (I%; hkl)] are: 7.02 (38; 002), 5.11 (33; 201), 4.649 (66; 003,$\overline{2}$03), 4.191 (100; 111), 3.339 (65; $\overline{4}$02,311,$\overline{3}$12), 2.967 (32; $\overline{2}$05,$\overline{1}$14,311), 2.343 (33; multiple), and 2.261(35; multiple). The unit-cell parameters refined from X-ray powder diffraction pattern are a = 13.552(6), b = 4.909(6), c = 15.091(6) Å, β = 111.50(1)°, and V = 934 Å^3. A crystal of 80 × 50 × 10 μm from the Trumbull Peak specimen was used for the collection of structure data. The structure, solved by direct methods, refined to R_1 = 0.108 on the basis of 323 unique $F_o > 4\sigma(F_o)$ reflections, with a = 13.601(4), b = 4.9222(10), c = 16.092(5) Å, β = 111.578(19)°, V = 939.6 Å^3, space group $C2$, Z = 2. The crystal structure of esquireite contains four-tetrahedra-thick $[Si_6O_{13}]^{2-}$ silicate layers parallel to {001} with $Ba(H_2O)_8^{2+}$ polyhedra between the layers. Another crystal from the Esquire #1 claim provided a supercell with all lattice parameters doubled. However, the pervasive twining and small dimensions of the crystal did not allow the authors to solve the supercell structure. The structure of esquireite is unique, although several other silicate minerals contain thick layers of tetrahedra in their structures: amstallite, kvanefjeldite, lemoynite, and chiappinoite-(Y). The name esquireite is for one of the type localities, the Esquire #1 claim. Five cotype specimens have been deposited in the collections of the Natural History Museum of Los Angeles County, Los Angeles, U.S.A., with catalogue numbers 64540, 64541, 64542, and 64543 from the Esquire #1 claim and with 64544 from Trumbull Peak. **F.C.**

FERROMERRILLITE*

S.N. Britvin, S.V. Krivovichev and T. Armbruster (2016) Ferromerrillite, $Ca_9NaFe^{2+}(PO_4)_7$, a new mineral from the Martian meteorites, and some insights into merrillite–tuite transformation in shergottites. European Journal of Mineralogy, 28, 125–136.

Ferromerrillite (IMA 2006-039), ideally $Ca_9NaFe^{2+}(PO_4)_7$, is a new mineral found as an accessory phase in shergottites, in the basaltic and olivine-phyric subgroups of those meteorites, where merrillite is found substantially enriched in iron, which substitutes for magnesium. Two basaltic shergottites have been studied for definition of the new mineral: Shergotty (the type occurrence) and Los Angeles (Warren et al. 2004). Ferromerrillite associated with clinopyroxene and maskelynite (the impact-melted plagioclase glass). Twenty anhedral grains of 15–20 μm in size have been extracted from sample of Shergotty and 30 grains of 20–50 μm in size from the sample of Los Angeles. Ferromerrillite grains are colorless and have no observable cleavage. They are non-fluorescent under short- and long-wave ultraviolet light. Luster is vitreous. Mohs hardness is ~5. In the immersion liquids (n = 1.625) grains are colorless and non-pleochroic. Ferromerrillite is optically uniaxial (–) to anomalously biaxial with $2V$ up to 20°. Refractive indexes are ω = 1.623 and 1.624; ϵ = 1.621 and 1.621 for the mineral

from Shergotty and Los Angeles, respectively (wavelength not reported). The density of the mineral from Shergotty could not be measured due to the scarcity of the material; D_{calc} = 3.11 g/cm^3. The density of the mineral from Los Angeles is D_{meas} = 3.14 g/cm^3 (sink-float method) D_{calc} = 3.17 g/cm^3. The average of 8 (Shergotty sample) and 10 (Los Angeles sample) electron probe EDS analyses (ranges not reported) [wt%, Shergotty/*wt%, Los Angeles*] is: Na_2O 1.7/*1.4*, CaO 46.8/*47.0*, MgO 1.5/*0.9*, FeO 3.5/*5.2*, P_2O_5 46.2/*45.7*, total 99.7/*100.2*. The empirical formula, based on 28 O apfu, is $Ca_{9.00}(Na_{0.60}Ca_{0.07})_{\Sigma0.67}(Fe^{2+}_{0.53}Mg_{0.40})_{\Sigma0.93}P_{7.08}O_{28}$ (Shergotty) and $Ca_{9.00}(Na_{0.49}Ca_{0.15})_{\Sigma0.64}(Fe^{2+}_{0.78}Mg_{0.23})_{\Sigma1.02}P_{7.03}O_{28}$ (Los Angeles). The strongest lines of the calculated powder X-ray diffraction pattern [d Å (I%; hkl) (Shergotty)/d Å (I%; hkl)(Los Angeles)] are: 6.46 (33; 104)/6.42 (20; 104), 5.196 (20; 110)/5.24 (10; 110), 3.423 (20; 1.0.10)/3.43 (10; 1.0.10), 3.191 (81; 214)/3.19 (60; 214), 2.861 (100; 2.0.10)/2.86 (100; 2.0.10), 2.741 (21; 218)/2.747 (20; 218), 2.594 (73; 220)/2.594 (50; 220), 1.710 (21; 2.0.20)/1.713 (20; 2.0.20). The trigonal unit-cell parameters refined from the powder data are (for Shergotty and Los Angeles, respectively): a = 10.370(9) and 10.379(2) Å; c = 37.17(9) and 37.06(2) Å, V = 3462 Å^3. The single-crystal X-ray study shows ferromerrillite is trigonal, $R3c$, a = 10.372(2), c = 37.217(13) Å, V = 3467 Å^3, Z = 6. A crystal 0.02 × 0.02 × 0.03 mm of ferromerrillite from Los Angeles sample was used for crystal structure determination. The crystal showed extremely high angular mosaicity owing to impact shock experienced by the host meteorite, a phenomenon, which is inherently typical for impact shocked crystals from shergottite meteorites. Data has been refined to R_1 = 0.066 on the basis of 1420 unique $F > 4\sigma(F)$ reflections. Ferromerrillite is isostructural with merrillite and is named as the Fe^{2+}-dominant analog of merrillite. The holotype specimen of ferromerrillite from Shergotty is deposited in the Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow. **F.C.**

Comment: No direct determination of Fe^{3+} content has been provided by the authors in their description. The authors discuss the iron oxidation state on the basis of statistical analysis of correlation of lattice parameters and composition of *M* sites of known whitlockite-type compounds with available chemical analyses of merrillite samples and of the calculated bond valence values obtained from refined structure data. They conclude that all iron is divalent in the studies samples of ferromerrillite. However, the authors report Fe^{3+} in the formulas reported at Tables 2 and 3. These are probably an uncorrected error left from a previous version of the draft manuscript and these Fe^{3+} should not be taken into account nor mentioned in future work. Oxidation state in martian minerals is a debated item and therefore particular attention should be paid to avoid propagation of erroneous data unsupported by strong evidences.

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FLUORNATROPYROCHLORE*

J. Yin, G. Li, G. Yang, X. Ge, H. Xu and J. Wang (2015) Fluornatropyrochlore, a new pyrochlore supergroup mineral from the Boziguoer rare earth element deposit, Baicheng County, Akesu, Xinjiang, China. Canadian Mineralogist, 53(3), 455–460.

The description of fluornatropyrochlore (IMA 2013-056), with a general formulae $(Na,Pb,Ca,REE,U)_2Nb_2O_6F$ changes status of this mineral from possible new species (Christy and Atencio 2013) to an officially approved species according current nomenclature of the pyrochlore supergroup (Atencio et al. 2010). The mineral was found in the alkali granite intruded into Silurian marble at the Boziguoer REE deposit, Baicheng County, Akesu, Xinjiang Autonomous Region, China (42°13′14″N; 81°54′29″E). It is closely associated with microcline, albite, aegirine, sodic amphibole, biotite, zircon, rutile, thorite, fluorite, fluocerite-(Ce), columbite-(Fe), xenotime-(Y), astrophyllite, chevkinite-(Ce), and fergusonite-(Y). Fluornatropyrochlore forms translucent to transparent brownish yellow to red-

dish orange, anhedral, rarely subhedral grains from 0.02 to 0.25 mm with an adamantine luster and light yellow streak. The mineral does not fluoresce in UV light. No cleavage or parting was observed. It is brittle with Mohs hardness 4–4½. The density was not measured; D_{calc} = 5.375 g/cm³. Fluornatropyrochlore is optically isotropic, n = 2.10(5) (589.9 nm). FTIR spectrum show the absence of bands of OH or H_2O groups with only single peak at 931 cm⁻¹. The average of 10 electron probe WDS analysis on 2 grains [wt%, (range)] is: Na_2O 6.80 (3.33–9.30), K_2O 0.01 (0–0.04), CaO 2.01 (1.69–2.22), MgO 0.01 (0–0.05), FeO 0.05 (0–0.15), SrO 0.03 (0–0.11), PbO 16.17 (14.75–18.77), Ce_2O_3 4.29 (3.76–5.41), La_2O_3 1.65 (1.37–1.93), Nd_2O_3 0.41 (0–0.62), Y_2O_3 0.42 (0.17–0.67), SiO_2 0.03 (0–0.09), TiO_2 1.36 (0.72–1.91), UO_2 5.81 (4.21–7.36), Ta_2O_5 3.00 (1.33–4.00), Nb_2O_5 53.42 (51.71–56.16), F 3.19 (2.33–4.12), Cl 0.02 (0–0.06), ThO_2 0.48 (0.13–1.41), Sb_2O_5 0.01 (0–0.07), ZrO_2 0.01 (0–0.13), MnO 0.04 (0–0.11), SnO_2 0.34 (0.23–0.41), –O=(F,Cl)₂, total 98.21. Ba, Al, and P were found below detection limit of 0.01 wt%. The empirical formula based on 7 anions pfu is: $(Na_{1.03}Pb_{0.34}Ca_{0.17}U_{0.10}Th_{0.01}Ce_{0.12}La_{0.05}Y_{0.02}Nd_{0.01})_{\Sigma1.85}$ $(Nb_{1.88}Ti_{0.08}Ta_{0.06}Sn_{0.01})_{\Sigma2.03}O_{6.21}F_{0.79}$. The strongest lines in the powder XRD pattern are [d Å (I; hkl)]: 6.074 (3; 111), 3.042 (100; 222), 2.628 (38; 004), 1.859 (34; 044), 1.582 (15; 226), 1.515 (4; 444), 1.3137 (2; 008), 1.2045 (3; 266), 1.1726 (2; 048), 1.0712 (1; 448). The mineral is cubic with a = 10.5053(10) Å, V = 1159.4 Å³, Z = 8, space group $Fd\bar{3}m$. The crystal structure was refined to R_1 = 0.053. Site-scattering refinement analysis shows that fluornatropyrochlore is characterized by F dominance at the Y site, Na dominance at the A site, and Nb dominance at the B site of the pyrochlore supergroup general formula $A_{2-m}B_2X_{6-w}Y_{1-n}$, where m = 0–1.7, w = 0–0.7, n = 0–1. The mineral name is given according the pyrochlore supergroup nomenclature rules. Type materials, including the polished thin section used for microprobe analyses, the single crystal used for crystal structure analysis, and a macro-crystal of fluornatropyrochlore, have been deposited in the Geological Museum of China, Beijing, China. **D.B.**

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FLUOR-SCHORL*

A. Ertl, U. Kolitsch, M.D. Dyar, H.-P. Meyer, G.R. Rossman, D.J. Henry, M. Prem, Th. Ludwig, L. Nasdala, C.L. Lengauer, E. Tillmanns and G. Niedermayr (2016) Fluor-schorl, a new member of the tourmaline supergroup, and new data on schorl from the cotype localities. European Journal of Mineralogy, 28(1), 163–177.

Fluor-schorl (IMA 2010-067), ideally $NaFe_3^{2+}Al_6Si_6O_{18}(BO_3)_3(OH)_3F$, is a new species of the tourmaline supergroup from alluvial tin deposits near Steinberg, Zschorlau, Erzgebirge (Saxonian Ore Mountains), Saxony, Germany, and from pegmatites near Grasstein (area from Mittewald to Sachsenklemme), Trentino, South Tyrol, Italy. Fluor-schorl was formed as a pneumatolytic phase associated to tin mineralization (Zschorlau) and in high-temperature hydrothermal veins in granitic pegmatites (Grasstein). Fluor-schorl is closely associated with quartz, biotite, albite, orthoclase, schorl, apatite, beryl, cassiterite, and "wolframite" (Zschorlau) and occurs as striated black prismatic crystals, up to 1×10 mm, that are often radially arranged and found in small quartz veins intergrown with quartz and feldspar. It occurs as tiny (maximum size of ~1 mm) prismatic tourmaline crystals with a pale brownish to pale grayish-bluish color, grown on top of quartz crystals (up to ~1 cm in length) in small veins in the pegmatite at Grasstein. It has a prismatic habit and shows the forms {120}, {$\bar{1}$00} (usually not clearly differentiated because of strong striation parallel to the **c** axis) and rarely {101}. Twinning was not observed. Fluor-schorl has no observable parting and a poor/indistinct cleavage parallel to {001}. It is

brittle, has a Mohs hardness of 7; D_{calc} = 3.23 g/cm³ and is non-fluorescent. In plane-polarized light, it is pleochroic, O = brown to gray-brown (Zschorlau), blue (Grasstein), E = pale gray-brown (Zschorlau), cream (Grasstein). Fluor-schorl is uniaxial negative, ω = 1.660(2)–1.661(2), ε = 1.636(2)–1.637(2). Optical absorption spectrum shows a pair of absorption bands in the E⊥**c** direction centered at about 732 and 1140 nm (Fe^{2+} absorptions with intensity enhanced in the E⊥**c** direction by interaction with Fe^{3+}). In Raman spectra fluor-schorl and schorl are differentiated in the high-energy spectral range, where fluor-schorl is characterized by generally lower intensity of the O–H stretching band at 3563 cm⁻¹. The average of 20 (Zschorlau) and 8 (Grasstein) electron probe WDS and SIMS analyses is [wt% (standard deviation; no range provided) Zschorlau/*Grasstein*]: Li_2O 0.04/*n.d.* (by SIMS), Na_2O 2.44(6)/*2.35(4)*, K_2O 0.05(1)/*0.04(1)*, CaO 0.06(1)/*0.02(1)*, MgO 0.89(4)/*0.07(1)*, ZnO 0.09(5)/*0.12(1)*, MnO 0.10(4)/*0.89(3)*, FeO_{total} 16.49(25)/*15.84(22)*, $FeO_{Möss}$ 15.83/*13.15*, $Fe_2O_{3Möss}$ 0.73/*2.99*, Al_2O_3 31.09(22)/*31.76(23)*, B_2O_3 (by SIMS) 9.86/*n.d.*, B_2O_{3calc} 10.00/*10.12*, TiO_2 0.73(2)/*0.17(2)*, SiO_2 33.44(19)/*34.38(12)*, F 1.20(5)/*1.40(5)*, H_2O (by SIMS) 2.70/*n.d.* H_2O_{calc} 2.88/*2.83*, –O=F_2 0.51/*–0.59*, total 99.06/*99.70*. The empirical formula based on 31 (O,OH,F) pfu are $^X(Na_{0.82}K_{0.01}Ca_{0.01}\square_{0.16})^Y(Fe_{2.30}^{2+}$ $Al_{0.38}Mg_{0.23}Li_{0.03}Mn_{0.02}^{2+}Zn_{0.01}\square_{0.03})_{\Sigma3.00}{}^Z(Al_{5.80}Fe_{0.10}^{3+}Ti_{0.10}^{4+})^T(Si_{5.81}Al_{0.19}O_{18})$ $(BO_3)_3{}^V(OH)_3{}^W[F_{0.66}(OH)_{0.34}]$ (Zschorlau) and $^X(Na_{0.78}K_{0.01}\square_{0.21})^Y(Fe_{1.89}^{2+}$ $Al_{0.58}Fe_{0.13}^{3+}Mn_{0.13}^{2+}Ti_{0.02}^{4+}Mg_{0.02}Zn_{0.02}\square_{0.21})_{\Sigma3.00}{}^Z(Al_{5.74}Fe_{0.26}^{3+})^T(Si_{5.90}Al_{0.10}O_{18})$ $(BO_3)_3{}^V(OH)_3{}^W[F_{0.76}(OH)_{0.24}]$ (Grasstein). The strongest lines in the X-ray powder diffraction pattern are [d Å, (I%; hkl)]: 2.584 (100; 051), 3.469 (99; 012), 2.959 (83; 122), 2.044 (80; 152), 4.234 (40; 211), 4.005 (39; 220), 6.382 (37; 101), 1.454 (36; 514) (Grasstein). 7.727 (100; 100), 4.461 (10; 111), 3.863 (40; 200), 2.732 (12; 220), 1.932 (16; 400). Crystal from both cotype locality were used for the collection of structure data. The mineral is rhombohedral, space group $R3m$, Z = 3. The structure, refined to R_1 = 0.018 on the basis of 2021 unique $F_o > 4\sigma(F_o)$ reflections, with a = 16.005(2), c = 7.176(1) Å, V = 1591.9 Å³ (Zschorlau) and to R_1 = 0.016 on the basis of 1682 unique $F_o > 4\sigma(F_o)$ reflections, with a = 15.995(1), c = 7.166(1) Å, V = 1587.7 Å³ (Grasstein). Several other samples of schorl were studied and chemical and structural data revealed several correlations: a distinct inverse correlation between the X–O2 distance (which reflects the mean ionic radius of the X-site occupants) and the F content (r^2 = 0.92), a strong positive correlation between the F content and the <Y–O> distance (r^2 = 0.93; Fe^{2+} richer tourmalines were also F-rich), and a strong positive correlation (r^2 = 0.82) between the refined F content and the observed Y–W (F,OH) distance. The latter is proposed as a quick estimation of the F content. The name "Schorl" was in use prior to the year 1400 AD because a village known today as Zschorlau (in Saxony, Germany) was then named "Schorl." Fluor-schorl is named according to the tourmaline supergroup classification (Henry et al. 2010). Parts of the cotype material are deposited in the Naturhistorisches Museum, Vienna, Austria (N 8165 from Zschorlau; N 8166 from Grasstein). Parts of the cotype material from Grasstein have also been catalogued by the "Museum of Nature South Tyrol," Bozen/Bolzano, Italy (catalogue no. MIN 9777). Parts of the cotype material of fluor-schorl from Zschorlau have also been deposited in the collections (Mineralogische Sammlung, Geowissenschaftliche Sammlungen) of the TU Bergakademie Freiberg, Saxony, Germany, with the number MiSa 83180. **F.C.**

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HOGARTHITE*

A.M. Mcdonald, P. Tarassoff and G.Y. Chao (2015) Hogarthite, $(Na,K)_2CaTi_2Si_{10}O_{26}\cdot8H_2O$, a new member of the lemoynite group from Mont Saint-Hilaire, Quebec: Characterization, crystal structure determination, and origin. Canadian Mineralogist, 53(1), 13–30.

The new mineral hogarthite, (IMA 2009-043), $(Na,K)_2CaTi_2Si_{10}O_{26}\cdot 8H_2O$, was discovered in vugs within metasomatically altered marble xenoliths in the Poudrette quarry, Mont Saint-Hilaire, La-Vallée-du-Richelieu RCM, Montérégie, Quebec, Canada, where it formed from a late-stage alkaline fluid enriched in SiO_2 and TiO_2, under conditions of low P at $T < 200$ °C, and possibly through crystallization of a gel. Hogarthite associated with calcite (several generations), quartz, haineaultite, labuntsovite-Mn, lemoynite, chabazite, and gmelinite-Na. Hogarthite forms dense, radiating crystal aggregates up to 0.5×3 mm. Individual crystals are bladed to blocky ($0.05 \times 0.15 \times 2$ mm in average), elongated by [100], flattened on {010} and bounded by the dominant pinacoid {010} and minor pinacoids {100} and {001}. Color varies from tan to white or colorless in different crystal zones. The streak is white and luster is satiny to silky or subvitreous. No fluorescence observed under UV radiation. The mineral is brittle with a perfect {010} cleavage, hackly to splintery fracture and estimated Mohs hardness of 4. Density was not measured; $D_{calc} = 2.40(1)$ g/cm³. Hogarthite is optically biaxial (+) with $\alpha = 1.567(1)$, $\beta = 1.591(1)$, $\gamma = 1.618(1)$ ($\lambda = 590$ nm), $2V_{meas} = 87(1)°$ and $2V_{calc} = 88(1)°$, $X = $ **b**, $Y \wedge $ **c** = 15° (in the obtuse angle β), $Z = $ **a**. IR/*Raman* spectra show bands (cm⁻¹, **rs** = relatively sharp, **s** = sharp, **b** = broad, **vb** = very broad) at 3612**rs**/*3607***b**, 3372**rb**, 3246**b**/*3411***vb**, *3239***vb** (OH stretch), 1645**rs**/*1608***vb** (H-O-H bend), Si-O stretch bands at 1126, 1016, 968, 935(all **s**)/*1190***b**, *1052***s**, *942***s**, *902***s**, and Si-O stretch bands at 788**s**, 712**s**, 678**s**/*794***rb**, *714***rb**, *679***s**. Other Raman sharp bands are Ti-O stretch 548, 448 cm⁻¹, Ti-O-Si, Ti-O-Ti stretch at 295, 258, 225 cm⁻¹, and lattice vibrations at 173, 135, 105 cm⁻¹. The average of 21 electron probe EDS analyses obtained on 7 crystals is [wt%, (range)]: Na_2O 2.37 (1.69–2.92), K_2O 2.88 (2.61–3.17), CaO 6.00 (5.40–6.31), TiO_2 14.44 (13.70–15.83), ZrO_2 1.11 (0.48–1.73), Nb_2O_5 0.78 (0.42–1.24), SiO_2 59.27 (57.32–60.64), H_2O 14.10 (calc), total 100.95. On the basis of 34 O apfu, the empirical formula is $(Na_{0.78}K_{0.62}\square_{0.51}Ca_{0.09})_{\Sigma 2.00}Ca(Ti_{1.85}Zr_{0.09}Nb_{0.06})_{\Sigma 2.00}Si_{10.09}O_{26}\cdot 8H_2O$. The strongest lines of the X-ray powder diffraction pattern are [d Å (I; hkl)]: 8.835 (85; 001), 7.913 (100; 020), 6.849 (70; $\bar{1}$11), 4.336 (45; $\bar{1}$31,$\bar{1}$12), 3.514 (80; 221), 3.426 (55; $\bar{2}$22,$\bar{1}$32). The crystal structure was solved by direct methods and refined to $R_1 = 0.049$ on the basis of 1335 unique $F_o > 4\sigma(F_o)$ reflections. Hogarthite is monoclinic, space group $C2/m$, with single-crystal unit-cell parameters $a = 10.1839(5)$, $b = 15.8244(6)$, $c = 9.1327(7)$ Å, $\beta = 104.463(2)$, $V = 1425.1$ Å³, $Z = 2$. The structure of hogarthite consists of a silicate component, composed of interconnected, non-planar 10-membered rings, arranged into thick slabs and stacked along [001], which are interleaved with layers of isolated TiO_6 octahedra, producing a framework of composition $[TiSi_5O_{13}]^{2-}$. Channels are thus present in the structure, which are partially filled by Na, Ca, K, and H_2O. Hogarthite belongs to the lemoynite group. The mineral is named for Donald D. Hogarth (b. 1929), Professor Emeritus in the Department of Earth Sciences at the University of Ottawa, in recognition of his contributions to the mineralogy and geology of the Grenville Province in Quebec and Ontario, and to the nomenclature of the pyrochlore group. The holotype specimen of hogarthite is housed in the collection of the Canadian Museum of Nature (Gatineau, Canada), catalogue number CMNMC 86086. **F.C.**

SHILOVITE*

N.V. Chukanov, S.N. Britvin, G. Möhn, I.V. Pekov, N.V. Zubkova, F. Nestola, A.V. Kasatkin and M. Dini (2015) Shilovite, natural copper(II) tetrammine nitrate, a new mineral species. Mineralogical Magazine, 79(3), 613–623.

Shilovite (2014-016), ideally $Cu(NH_3)_4(NO_3)_2$, is a new mineral found at the Pabellón de Pica Mountain, near Chanabaya, Iquique Province, Tarapacá Region, Chile. Associated minerals include halite, ammineite, atacamite, and thénardite. The host rock is a gabbro that consists of amphibole, plagioclase, and minor clinochlore, and contains accessory chalcopyrite that is considered the source of Cu for shilovite. Shilovite forms imperfect, thick tabular to equant crystals up to 0.15 mm in size included in massive halite. The new mineral is deep violet blue with a violet blue streak that changes to light blue as a result of decomposition and loss of NH_3. Crystals of shilovite are translucent with a vitreous luster, are sectile and show no cleavage. Density was not measured due to the small grain size of crystals and the instability of the mineral in available heavy liquids. $D_{calc} = 1.92$ g/cm³. Mohs hardness ≤ 2. Shilovite is optically biaxial (+), $\alpha = 1.527(2)$, $\beta = 1.545(5)$, $\gamma = 1.610(2)$, $2V \approx 40$–50°, but could not be determined accurately because the mineral decomposes rapidly in immersion liquids. $2V_{calc} = 57°$. Shilovite is non-fluorescent. The main absorption bands of the IR spectrum (cm⁻¹, w = weak, s = strong) are: 3200–3700 (N-H stretching vibrations), 1700–3000w (overtones and combination modes involving N-O stretching and H-N-H bending), 1650 (degenerate bending vibrations of NH_3 molecules), 1361s and 1431s (asymmetric stretching vibrations of NO_3^- anions), 900–1200s (bending modes of NH_3 molecules), 882 and 732 (out-of-plane and in-plane bending vibrations of NO_3^- anions, respectively), bands below 700 (rocking and translational modes of NH_3 molecules). The average of 3 electron probe EDS analyses [wt% (range)] is: Cu 26.04 (24.67–27.09), Fe 0.31 (0.22–0.48), N 30.80 (29.77–32.39), O 35.95 (34.28–37.77), H (calculated from an ideal formula) 4.74, total 97.84. This gives the empirical formula $H_{12.56}(Cu_{1.09}Fe_{0.01})N_{5.87}O_{6.00}$ based on 6 O apfu. The strongest lines in the X-ray powder-diffraction pattern [d (Å) ($I\%$; hkl)] are: 5.931 (41; 400), 5.841 (100; 011), 5.208 (47; 410), 4.162 (88; 411), 4.005 (62; 420), 3.462 (50; 002), 3.207 (32; 031), 2.811 (40; 412). The unit-cell dimensions refined from the powder data are $a = 23.741(9)$, $b = 10.853(1)$, $c = 6.922(2)$ Å, $V = 1783.6$ Å³. Single-crystal X-ray diffraction data collected on a crystal of size $0.04 \times 0.05 \times 0.07$ mm refined to $R_1 = 0.029$ for 2705 unique $I \geq 4\sigma(I)$ reflections shows shilovite is orthorhombic, space group $Pnn2$, $a = 23.6585(9)$, $b = 10.8238(4)$, $c = 6.9054(3)$ Å, $V = 1768.3$ Å³, $Z = 8$. The crystal structures of shilovite and synthetic $[Cu(NH_3)_4](NO_3)_2$ are similar, except for the arrangement of H atoms of NH_3 groups, which leads to a non-centrosymmetric space group in the case of shilovite. The structural unit of shilovite has a Cu atom coordinated by four NH_3 molecules in near-square planar fashion and two nitrate anions coordinating *via* oxygen atoms. Shilovite was named in honor of the outstanding Russian chemist and Academician of the Russian Academy of Sciences, Alexander Evgen'evich Shilov (1930–2014), a specialist in biomimetics and the chemistry of nitrogen. The holotype specimen is deposited in the collection of the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. **O.C.G.**

TAPIAITE*

A.R. Kampf, S.J. Mills, B.P. Nash, M. Dini and A.A. Molina Donoso (2015) Tapiaite, $Ca_5Al_2(AsO_4)_4(OH)_4\cdot 12H_2O$, a new mineral from the Jote mine, Tierra Amarilla, Chile. Mineralogical Magazine, 79(2), 345–354.

Tapiaite (IMA 2014-024), ideally $Ca_5Al_2(AsO_4)_4(OH)_4\cdot 12H_2O$, is a new mineral found at the Jote mine, Tierra Amarilla, Copiapó Province, Atacama, Chile. Tapiaite is a late-stage, low-temperature, secondary mineral that occurs in narrow seams and vugs in the oxidized upper portion of a hydrothermal sulfide vein hosted by volcanoclastic rocks. The deeper unoxidized portion of the vein contains primary and supergene minerals including acanthite, native arsenic, Ag sulfosalts, barite, calcite, chalcopyrite, domeykite, feldspar, pyrite, quartz, native silver, and stibnite. Tapiaite associated with conichalcite, joteite, mansfieldite, pharmacoalumite, pharmacosiderite, and scorodite. Crystals occur as colorless blades up to ~0.5 mm long flattened on {10$\bar{1}$} and elongated and striated along [010]. The blades are commonly intergrown in subparallel bundles and less commonly in sprays. Forms {101}, {$\bar{1}$01}, and {111} are observed. Crystals are easily soluble in dilute HCl at room temperature and slowly soluble in H_2O. Tapiaite is transparent with white streak and vitreous luster, is brittle, has splintery fracture, perfect cleavage on {101} and {10$\bar{1}$}, and shows no twinning. It does not fluoresce under UV light. The Mohs hardness is

~2–3. Density was not measured due to the crystals being too difficult to see in Clerici solution. D_{calc} = 2.681 g/cm³. Tapiaite is non-pleochroic, optically biaxial (+) with α = 1.579(1), β = 1.588(1), γ = 1.610(1), $2V_{meas}$ = 66(2)°, and $2V_{calc}$ = 66°; $X ≈ [10\bar{1}]$; $Y = b$, $Z ≈ [101]$. The average of 5 electron probe WDS analyses on 5 crystals [wt% (range)] is: Na_2O 0.09 (0.04–0.16), CaO 24.96 (24.13–25.89), CuO 0.73 (0.15–1.75), Al_2O_3 10.08 (9.48–10.70), Fe_2O_3 0.19 (0.04–0.41), As_2O_5 40.98 (39.84–42.56), Sb_2O_5 0.09 (0.07–0.13), H_2O 23.46 [calculated on the basis of 11 total cations (Ca+Na+Cu+Al+Fe+As+Sb), charge balance and 32 O], total 100.58. This gives the empirical formula $(Ca_{4.83}Cu^{2+}_{0.10}Na_{0.03})_{Σ4.96}(Al_{2.14}Fe^{3+}_{0.03})_{Σ2.17}$ $[(As^{5+}_{3.87}Sb^{5+}_{0.01})_{Σ3.88}O_{16}][(OH)_{3.76}(H_2O)_{0.24}]_{Σ4}(H_2O)_{10}·2H_2O$ based on 32 O apfu. The strongest lines in the X-ray powder-diffraction pattern [d Å (I%; hkl)] are: 13.91 (100; $\bar{1}$01), 7.23 (17; 200,002), 5.39 (22; 110,011), 4.64 (33; $\bar{1}1\bar{2}$, $\bar{2}$11,$\bar{3}$03), 3.952 (42; $\bar{1}1\bar{3}$,$\bar{3}$11,$\bar{2}$13), 3.290 (35; $\bar{2}$14,$\bar{4}$12,$\bar{1}$14,$\bar{4}$11), 2.823 (39; 303,$\bar{3}$15), 2.753 (15; $\bar{5}$13,$\bar{1}$15,121,$\bar{5}$11). The unit-cell parameters refined from powder-diffraction data are: a = 16.008(8), b = 5.767(9), c = 16.367(8) Å, β = 116.72(2)°, and V = 1350 Å³. Single-crystal X-ray diffraction data collected on a crystal of size 70 × 30 × 10 μm refined to R_1 = 0.0537 for 1733 unique $I ≥ 4σ(I)$ reflections shows tapiaite is monoclinic, $P2_1/n$, with unit-cell parameters a = 16.016(1), b = 5.7781(3), c = 16.341(1) Å, β = 116.704(8)°, V = 1350.9 Å³, and Z = 2. The structure of tapiaite consists of a backbone chain of *trans*-edges-sharing AlO_6 octahedra where adjacent octahedra are further linked to one another by AsO_4 tetrahedra in a staggered arrangement, forming $Al(AsO_4)(OH)_2$ chains of octahedra and tetrahedra. These chains are topologically identical to the chain in the structure of linarite. CaO_8 polyhedra condense to these chains, forming columns, where CaO_8 polyhedra in adjacent columns link to one another by corner-sharing to form thick layers parallel to $\{10\bar{1}\}$, further linked to AsO_4 tetrahedra. An extensive system of hydrogen bonds links the framework. The new mineral is named tapiaite for Enrique Tapia (1955–2008), a well-known Chilean mineral collector. Four cotype specimens are deposited in the Natural History Museum of Los Angeles County, U.S.A. **O.C.G.**

WAIMIRITE-(Y)*

D. Atencio, A.C. Bastos Neto, V.P. Pereira, J.T.M.M. Ferron, M. Hoshino, T. Moriyama, Y. Watanabe, R. Miyawaki, J.M.V. Coutinho, M.B. Andrade, K. Domanik, N.V. Chukanov, K. Momma, H. Hirano and M. Tsunematsu (2015) Waimirite-(Y), orthorhombic YF₃, a new mineral from the Pitinga mine, Presidente Figueiredo, Amazonas, Brazil and from Jabal Tawlah, Saudi Arabia: description and crystal structure. Mineralogical Magazine, 79(3), 767–780.

Waimirite-(Y) (IMA 2013-108), orthorhombic YF_3, is a new mineral found at the A-type Madeira granite (~1820 Ma), at the Pitinga mine, Presidente Figueiredo Co., Amazonas State, Brazil, as well as at Jabal Tawlah (Mount Tawlah) in the Kingdom of Saudi Arabia. At the Pitinga mine, the mineral occurs in hydrothermal veins (up to 30 mm thick) cross-cutting the albite-enriched facies associated with halloysite. Minerals in the granite are K-feldspar, albite, quartz, riebeckite, biotite, muscovite, cryolite, zircon, polylithionite, cassiterite, pyrochlore-group minerals, columbite, thorite, native lead, hematite, galena, fluorite, xenotime-(Y), gagarinite-(Y), fluocerite-(Ce), genthelvite-helvite, topaz, illite, kaolinite, and chlorite. At Jabal Tawlah, waimirite-(Y) occurs in hydrothermally altered quartz-rich microgranite, also as the main REE mineral. Associated minerals include biotite, albite, muscovite, microcline, columbite-(Fe), zircon, thorite, xenotime-(Y), samarskite-(Y), ilmenite, an undetermined Ca-Y-F mineral, euxenite-(Y), fergusonite-(Y), rutile, illite, barite, calcite, and goethite. Waimirite-(Y) formed from fluorine-rich hydrothermal fluids containing large amounts of REE. Waimirite-(Y) from Brazil occurs as aggregates of platy crystals up to ~1 μm. Forms observed (determined on synthetic YF_3 only) are pinacoids, prisms, and bipyramids. Crystals are pink with white streak, are transparent to translucent with non-metallic luster, show no cleavage (synthetic YF_3 shows perfect cleavage on {010}) or parting. The Mohs hardness and density was not measured due to the small crystal size; D_{calc} = 5.586 g/cm³. Waimirite-(Y) is biaxial, mean n = 1.54–1.56. It is non-fluorescent under UV radiation. Waimirite-(Y) from Saudi Arabia occurs as inclusions in an undetermined Ca-Y-F mineral where anhedral-to-subhedral crystals of several tens to several hundreds of micrometers in size are common. The mineral is colorless with white streak, is transparent with vitreous luster, shows no cleavage, has irregular to conchoidal fracture and is brittle. The density was not measured because of small grain size; D_{calc} = 5.678 g/cm³. The indentation hardness VHN_{100} = 700 (667–786) kg/mm² corresponding to 5–6 of the Mohs scale. It is optically biaxial (+) with $2V$ = 70–80° and mean refractive index $n ≈ 1.60$. At the IR spectrum of the material from Brazil polluted with a halloysite a strong band at 380 cm⁻¹ (with shoulders at 400 and 440 cm⁻¹) belongs to waimirite-(Y). IR spectrum demonstrates the absence of carbonate and borate groups. The average of 24 electron probe WDS analyses on the sample from Brazil [wt% (range)] is: F 29.27 (28.43–30.19), Y 37.25 (34.78–38.89), La 0.19 (0.01–0.28), Ce 0.30 (0.19–0.46), Pr 0.15 (0.03–0.25), Nd 0.65 (0.57–0.81), Sm 0.74 (0.66–0.87), Gd 1.86 (1.65–2.09), Tb 0.78 (0.60–0.95), Dy 8.06 (7.36–8.81), Ho 1.85 (1.47–2.35), Er 6.38 (5.80–7.24), Tm 1.00 (0.69–1.34), Yb 5.52 (4.99–6.16), Lu 0.65 (0.38–1.58), Ca 0.83 (0.71–0.97), O 2.05 (calculated by charge balance), total 97.53. This gives the empirical formula $(Y_{0.69}Dy_{0.08}Er_{0.06}Yb_{0.05}Ca_{0.03}Gd_{0.02}Ho_{0.02}Nd_{0.01}$ $Sm_{0.01}Tb_{0.01}Tm_{0.01}Lu_{0.01})_{Σ1.00}[F_{2.54}\square_{0.25}O_{0.21}]_{Σ3.00}$ based on 1 cation pfu. The average of 24 electron probe WDS analyses on the sample from Saudi Arabia [wt% (range)] is: F 34.34 (33.44–35.19), Y 44.61 (43.22–48.84), Ce 0.08 (0.04–0.12), Nd 0.04 (0.02–0.07), Sm 0.14 (0.11–0.18), Gd 2.95 (2.57–3.41), Tb 0.72 (0.59–0.81), Dy 7.77 (6.84–7.96), Ho 2.27 (1.95–2.50), Er 5.39 (5.05–5.68), Tm 0.69 (0.61–0.75), Yb 1.36 (1.03–1.56), Na 0.06 (0.02–0.09), Ca 0.08 (0.03–0.05), O 0.80 (by charge balance), total 101.30. This gives the empirical formula $(Y_{0.79}Dy_{0.08}Er_{0.05}Gd_{0.03}Ho_{0.02}Tb_{0.01}$ $Tm_{0.01}Yb_{0.01})_{Σ1.00}[F_{2.85}O_{0.08}\square_{0.07}]_{Σ3.00}$ based on 1 cation pfu. The strongest lines in the X-ray powder-diffraction pattern of waimirite-(Y) from Brazil [d (Å) (I%; hkl)] are: 3.707 (26; 011), 3.623 (78; 101), 3.438 (99; 020), 3.205 (100; 111), 2.894 (59; 210), 1.937 (33; 131), 1.916 (24; 301), 1.862 (27; 230). The unit-cell parameters refined from powder-diffraction data, by analogy with the synthetic equivalent, are a = 6.386(1), b = 6.877(1), c = 4.401(1) Å, V = 193.28 Å³, Z = 4. Single-crystal X-ray diffraction data collected on a crystal from Saudi Arabia of size 0.05 × 0.03 × 0.02 μm refined to R_1 = 0.0163 for 191 unique $I ≥ 2σ(I)$ reflections shows waimirite-(Y) is orthorhombic, $Pnma$, a = 6.38270(12), b = 6.86727(12), c = 4.39168(8) Å, V = 192.495 Å³, Z = 4. Waimirite-(Y) is isomorphous with synthetic SmF_3, HoF_3, and YbF_3. The crystal structure of waimirite-(Y) consists of Y atom that are ninefold-coordinated to form YF_9 tricapped trigonal prisms. The name waimirite is for the Waimiri-Atroari Indian people of Roraima and Amazonas, while the "Y" suffix was introduced because it is a rare-earth mineral. Type material has been deposited in the Museu de Geociências, Instituto de Geociências, Universidade de São Paulo, Brazil, and in the Museu de Mineralogia Luiz Englert, Departamento de Mineralogia e Petrologia, Instituto de Geociências, Universidade Federal do Rio Grande do Sul, Brazil. Part of the cotype sample has been deposited at the University of Arizona Mineral Museum, RRUFF Project. **O.C.G.**