New Mineral Names*,†

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In this issue

This New Mineral Names has entries for eight new minerals, including batievaite-(Y), bunnoite, castellaroite, chongite, gajardoite, jeffbenite, lucchesiite, and tvrdýite.

BATIEVAITE-(Y)*

L.M. Lyalina, A.A. Zolotarev Jr., E.A. Selivanova, Ye.E. Savchenko, S.V. Krivovichev, Yu.A. Mikhailova, G.I. Kadyrova, and D.R. Zozula (2016) Batievaite-(Y), $Y_2Ca_2Ti[Si_2O_7]_2(OH)_2(H_2O)_4$, a new mineral from nepheline syenite pegmatite in the Sakharjok massif, Kola Peninsula, Russia. Mineralogy and Petrology, 110(6), 895–904.

Batievaite-(Y) (IMA 2015-016), ideally $Y_2Ca_2Ti[Si_2O_7]_2(OH)_2(H_2O)_4$, triclinic, is a new mineral discovered at the Sakharjok alkaline massif, Western Keivy, Kola Peninsula, Russia. It occurs in pegmatite body intruded within the contact zone between nepheline syenite and essexite and consisting of nepheline, albite, alkaline pyroxenes, amphiboles, biotite and zeolites. Other minerals in the pegmatite are: behoite, minerals of britholite, pyrochlore, apatite groups and gadolinite-subgroup, calcite, cerianite-(Ce), fluorite, ilmenite, leucophanite, meliphanite, mimetite, molybdenite, nickeline, rutile, smectite, titanite, thomsonite-Ca, zircon, and zirkelite. Batievaite-(Y) formed in a late-pegmatitic or hydrothermal stage and it is found in aggregates of leucocratic minerals closely associating with hainite. It forms euhedral elongated or tabular crystals (average length 0.25–0.3 mm; up to 1.6 mm) and their intergrowths. Anhedral grains are rare. Grains of batievaite-(Y) are typically surrounded by Na-richer rims of hainite 0.01–0.15 mm thick. The hainite rims are separated from the batievaite-(Y) core by cracks filled with aggregates of calcite, albite, natrolite. The new mineral is pale-cream to almost white or very pale tan, rarely brown, with white streak and dull, greasy, or, sometimes, pearly luster. The mineral is non-fluorescent in UV light. No cleavage or parting was observed. The Mohs hardness is 5–5½; $D_{meas} = 3.45(5)$ g/cm³, $D_{calc} = 3.51$ g/cm³. In transmitted light batievaite-(Y) is non-pleochroic colorless. It is optically biaxial (+), $α = 1.745(5)$, $β = 1.747(5)$, $γ = 1.752(5)$ ($λ = 589$ nm), $2V_{meas} = 60(5)°$, $2V_{calc} = 65°$; $X \sim \mathbf{c}$. Dispersion of optical axes is moderate $r > v$. The IR spectrum of the powdered sample of batievaite-(Y) contains the bands (cm^{-1}): 483 and 584 (bending vibrations of the Si_2O_7), 649 (probably Si-O-Si vibrations), 800, 877, and 985 (Si–O stretching vibrations of the Si_2O_7), 1630 and 1646 (bending vibrations of H_2O), 1732 (bending vibrations of H_3O^+), 3426 (stretching vibrations of H_2O). The average of 6 electron probe WDS analyses on three different crystals is [wt% (range)]: SiO_2 30.0 (29.6–30.8), Al_2O_3 0.56 (0.38–0.66), TiO_2 8.01 (6.77–8.96), ZrO_2 2.72 (1.63–4.18), Nb_2O_5 2.25 (1.85–2.98), MnO 1.31 (0.94–1.75), MgO

0.01 (0–0.06), Fe_2O_3 0.43 (0.22–0.53), CaO 24.98 (23.9–26.00), Na_2O 1.13 (0.59–1.63), K_2O 0.02 (0–0.05), Y_2O_3 11.45 (10.6–12.2), La_2O_3 0.22 (0–0.30), Ce_2O_3 0.33 (0.23–0.44), Nd_2O_3 0.02 (0–0.11), Gd_2O_3 0.07 (0–0.15), Dy_2O_3 0.47 (0.29–0.65), Er_2O_3 1.07 (0.84–1.42), Tm_2O_3 0.25 (0.17–0.39), Yb_2O_3 2.81 (2.37–3.60), Lu_2O_3 0.45 (0.23–0.71), F 2.88 (1.98–3.96) (by EDS), Cl 0.19 (0.04–0.35), H_2O 6.75 (on the basis of crystal structure data), $-O=(F,Cl)_2$ 1.25, total 97.09. No explanation of low total is provided. The empirical formula based Si + Al = 4 pfu and considering data of structural analysis is $(Y_{0.81}Ca_{0.65}Mn_{0.15}Zr_{0.12}Yb_{0.11}Er_{0.04}Fe^{3+}_{0.04}Ce_{0.02}Dy_{0.02}Lu_{0.02}La_{0.01}Tm_{0.01})_{Σ2.00}[(H_2O)_{0.75}Ca_{0.70}\square_{0.55}]_{Σ2.00}Ca_{2.00}[\square_{0.61}Na_{0.25}(H_2O)_{0.14}]_{Σ1.00}(Ti_{0.76}Nb_{0.15}Zr_{0.09})_{Σ1.00}[(Si_{3.91}Al_{0.09})_{Σ4.00}O_{14}][(OH)_{1.56}F_{0.44}]_{Σ2.00}[(H_2O)_{1.27}F_{0.73}]_{Σ2.00}$. The strongest lines in the X-ray powder diffraction pattern [d Å (I; hkl)] are: 2.991 (100; 11$\bar{2}$), 7.238 (36; 00$\bar{1}$), 3.061 (30; 300), 4.350 (23; 0$\bar{1}\bar{1}$), 9.145 (17; 100), 4.042 (16; 11$\bar{1}$), 2.819 (16; 3$\bar{1}$0), 3.745(13; 2$\bar{1}$0). The triclinic unit-cell parameters refined from the powder data are: $a = 9.431(8)$, $b = 5.556(4)$, $c = 7.375(5)$ Å, $α = 90.10(4)$, $β = 101.44(8)$, $γ = 96.60(6)°$, $V = 376.4$ Å³, space group $P\bar{1}$, $Z = 1$. The single-crystal unit-cell parameters are: $a = 9.4024(8)$, $b = 5.5623(5)$, $c = 7.3784(6)$ Å, $α = 89.919(2)$, $β = 101.408(2)$, $γ = 96.621(2)°$, $V = 375.65$ Å³. The structure was solved by direct methods and refined to $R_1 = 0.0577$ for 5115 independent $I > 2σ(I)$ reflections. The crystal structure of batievaite-(Y) is similar to hainite $Na_2Ca_4(Y,REE)Ti(Si_2O_7)_2OF_3$ and götzenite $NaCa_6Ti(Si_2O_7)_2OF_3$. It is based upon HOH blocks where the heteropolyhedral H-layer composed of $M1O_n$ and $M3O_n$ polyhedra ($n = 6–8$) linked to Si_2O_7 groups. The octahedral O-layer contains M2, M4, and M5 cation sites. The structure of batievaite-(Y) differs from that of hainite in the composition of the O-layer. In batievaite-(Y), M4 is predominantly vacant, with only 39% total occupancy by Na and H_2O molecules. The crystal structure of batievaite-(Y) contains two mixed anion positions: X8-(OH,F) and X9-(H_2O,F) [in hainite, there are one F and one half mixed (O,F) positions]. The cation (M2, M4) and anion (X9) positions in the structure of batievaite-(Y) are partially occupied by H_2O molecules, which is possible because of the vacancies in the O-layers. The M1 site in batievaite-(Y) is preferentially occupied by Y^{3+} and has a sevenfold coordination, instead of the octahedral (sixfold) coordination of the M1 site in hainite that is dominantly occupied by Ca. Thus batievaite-(Y) considered as the Na-deficient Y-analogue of hainite. The mineral is named in honor of the Russian geologist Iya Dmitrievna Batieva (1922–2007) in recognition of her remarkable contribution into the geology and petrology of metamorphic and alkaline complexes of the Kola Peninsula. The holotype specimen of is housed in the I.V. Bel'kov Museum of Geology and Mineralogy of the Geological Institute of the Kola Science Centre of the Russian Academy of Sciences, Apatity, Murmansk region, Russia. **D.B.**

BUNNOITE*

D. Nishio-Hamane, K. Momma, R. Miyawaki, and T. Minakawa (2016) Bunnoite, a new hydrous manganese aluminosilicate from Kamo Mountain, Kochi prefecture, Japan. Mineralogy and Petrology, 110(6), 917–926.

Bunnoite (IMA 2014-054), ideally $Mn_6^{2+}AlSi_6O_{18}(OH)_3$, triclinic, is a new mineral discovered at Kamo Mountain in Ino, Kochi Prefecture, Japan (33°33′24.4″ N; 133°25′29.4″ E). The mineral was initially reported as akatoreite (Minakawa 2000). The mineral found in one of small-scale iron-manganese deposits formed from iron- and manganese-rich marine sediments during low-grade metamorphism. Bunnoite occurs as veins and lenses randomly crossing hematite-rich ferro-manganese ore in association with stilpnomelane, rhodonite, piemontite, and quartz. It is supposed to be formed by the hydrothermal activity at the later stages of metamorphism. The mineral forms dull green, foliated subhedral crystals up to 0.5 mm in length or yellowish-green, fine-grained aggregates. Bunnoite is translucent to transparent with a vitreous luster and a dull green streak. It exhibits perfect cleavage on {012} and is brittle with an uneven fracture. The Mohs hardness is 5½. The density was not measured due to the presence of inclusions; D_{calc} = 3.63 g/cm³. The mineral is optically biaxial (+), α = 1.709, β = 1.713, γ = 1.727 (white light), $2V_{meas}$ = 54°, $2V_{calc}$ = 57°. Pleochroism varies from pale greenish yellow to brownish yellow (orientation not specified). The Raman spectrum of bunnoite shows the peaks in the region below 900 cm⁻¹ (metal–anion stretching vibrations), peaks in the region of 3400–3600 cm⁻¹ (O–H stretching). No peaks were found between 1200 and 1800 cm⁻¹, indicating the absence of H–O–H bending vibrations. The average of 5 electron probe EDS analyses is [wt% (range)]: SiO_2 40.44 (39.60–41.40), Al_2O_3 4.15 (3.30–5.16), Fe_2O_3 6.98 (6.04–8.36) [FeO 2.05 and Fe_2O_3 4.70 by stoichiometry], MnO 43.50 (42.10–44.49), MgO 1.26 (1.11–1.44), CaO 0.20 (0.12–0.25), H_2O 3.09 (by stoichiometry); total 99.19. The empirical formula of bunnoite based on O = 18 and OH = 3 pfu is $(Mn_{5.36}^{2+}Mg_{0.27}Fe_{0.25}^{2+}Fe_{0.11}^{3+})_{\Sigma 6.00}(Al_{0.60}Fe_{0.40}^{3+})_{\Sigma 1.00}$ $(Si_{5.89}Al_{0.11})_{\Sigma 6.00}O_{18}(OH)_3$. The strongest lines of the powder X-ray diffraction pattern are [d Å (I%; hkl)]: 4.671 (54; 1$\bar{1}$$\bar{1}$), 3.468 (37; 023,221), 3.334 (92; 1$\bar{2}$1,1$\bar{1}$2), 3.320 (89; 201), 2.712 (70; 1$\bar{1}$3), 2.657 (100; 1$\bar{1}$$\bar{4}$,22$\bar{2}$), 2.636 (43; 233), 2.609 (40; 104), 2.216 (60; 1$\bar{1}$$\bar{5}$,144), 2.203 (40; 040), 2.180 (48; $\bar{2}$13,204). The mineral is triclinic $P\bar{1}$. The unit-cell parameters refined from powder X-ray diffraction data are a = 7.521(5), b = 10.008(8), c = 12.048(2) Å, α = 70.46(5)°, β = 84.05(6)°, γ = 68.31(6)°, V = 793.9 Å³, Z = 2. The single-crystal unit-cell parameters are: a = 7.505(3), b = 9.987(3), c = 12.060(4) Å, α = 70.526(5)°, β = 84.224(7)°, γ = 68.460(4)°, V =792.4 Å³. The crystal structure of bunnoite has been solved by the charge flipping method and refined to R_1 = 0.0334 for 4386 independent I > 2σ(I) reflections. Bunnoite has a layered structure with alternating tetrahedral and octahedral sheets parallel to the ($\bar{1}$11). In the tetrahedral sheets, there are six unique Si sites. These six Si tetrahedra form sorosilicate $[Si_6O_{18}(OH)]$ clusters. There are six unique Mn sites and one unique Al site in the octahedral sheets. The octahedra share edges to form continuous strips linked by $[Mn_2O_8]$ edge-sharing dimers. The structure of bunnoite is generally similar to that of akatoreite for which the sorosilicate cluster is shorter: $[Si_4O_{12}(OH)]$. Bunnoite is the only mineral known to contain $[Si_6O_{18}(OH)]$ clusters. Analogous $[VSi_5O_{18}(OH)]$ clusters have been found in medaite, $Mn_6^{2+}V^{5+}Si_5O_{18}(OH)$. The mineral has been named in honor of the Japanese mineralogist Michiaki Bunno (b. 1942), who before retirement was the chief curator for the Geological Museum of the Geological Survey of Japan, for his contributions to museum and to the discovery of a number of new minerals. The type specimen has been deposited in the collections of the National Museum of Nature and Science, Japan. **D.B.**

Reference cited

Minakawa, T. (2000) Akatoreite from iron-manganese deposit of Kamo Mountain in Kurosegawa zone. Abstracts with Programs of Annual Meeting of the Mineralogical Society of Japan, the Mineralogical Society of Japan, P15, 107.

CASTELLAROITE*

A.R. Kampf, F. Cámara, M.E. Ciriotti, B.P. Nash, C. Belestra, and L. Chiappino (2016) Castellaroite, $Mn_3^{2+}(AsO_4)_2 \cdot 4.5H_2O$, a new mineral from Italy related to metaswitzerite. European Journal of Mineralogy, 28(3), 687–696.

Castellaroite (IMA 2015-071), ideally $Mn_3^{2+}(AsO_4)_2 \cdot 4.5H_2O$, was first discovered from the dump at the Monte Nero mine, Rocchetta Vara, La Spezia, Liguria, Italy, where the deposit is comprised of thin manganese stratiform ores located near the base of a chert sequence, which overlies Jurassic ophiolites of the Bracco unit. There, castellaroite is a secondary mineral crystallized from As- and Mn-rich fluids. At Monte Nero, the new mineral occurs with coralloite, manganohörnesite, rhodochrosite, sarkinite, sterlinghillite, strashimirite, and wallkilldellite. Castelloroite was also found in the dumps of the Valletta mine, near Canosio, Piedmont, Italy. At the Valletta mine, castellaroite is a secondary mineral as well and occurs with braccoite, hematite, manganberzeliite, orthoclase, and tiragalloite. At the Monte Nero mine, castellaroite occurs in radial aggregates up to about 5 mm in diameter consisting of thin blades, and rarely as individual crystals up to about 2 mm long. At the Valletta mine, it forms aggregates of thin blades up to about 0.5 mm in length. Blade crystals are flattened on [001], striated and elongated parallel to [100]. The {110}, {012}, and {001} forms are observed. Castellaroite is colorless, transparent with a vitreous to silky luster and white streak. No twinning was observed. The new mineral is non-fluorescent. Crystals are flexible with a curved fracture, and have perfect cleavage on {001}. The Mohs hardness is 2½. D_{meas} = 3.14(2) g/cm³; D_{calc} = 3.164 g/cm³. Castellaroite is non-pleochroic, optically biaxial (–), α = 1.644, β = 1.662, and γ = 1.667 (white light), $2V_{meas}$ = 57(1)°; $2V_{calc}$ = 55°; Y = **b**; Z ≈ **a**. Dispersion of the optical axes is moderate r < v. The new mineral easily dissolves in dilute HCl at room temperature. Raman spectroscopy identified a number of bands both in Monte Nero and Valetta castellaroite specimens (values for the *Valletta* specimen are given in italic): main bands at 800.5(*800.4*), 822.2(*821.9*), 846.8(*843.5*) and 862.5(*869.9*) cm⁻¹, with two weaker shoulders at 910.6(*910.2*) and 933.8 cm⁻¹, the latter not well resolved in the Valletta spectrum; a prominent band centered at 425.6(*426.5*) cm⁻¹ is flanked on one side by two well-resolved peaks at 340(*346.9*) and 371.5(*376.1*) and on the other by a peak at 459.4(*447.2*) cm⁻¹; two weaker bands observed at 503.6 and 577.5 cm⁻¹; five weakly resolved bands can be recognized for the Monte Nero sample at 108.9, 149.9, 181.9, 215.1, and 256.9 cm⁻¹, with a shoulder at 143.2 cm⁻¹ (the same bands are observed for the Valletta sample at *111.4, 149.6, 177.8, 215.9* and *252.1* cm⁻¹, with the shoulder shifted to lower wavenumbers and better resolved (*135.7* cm⁻¹) and a better resolved band at *177.8* that is very weak and split into two shoulders of adjacent bands at lower and higher wavenumbers (*165.0, 191.4*). In the Raman spectrum for the Monte Nero sample, a very weak band centered at 1662.6 cm⁻¹ is observed corresponding to the bending vibrations of H_2O; the bands due to hydroxyl stretching modes of the H_2O groups are observed at 2925.1, 3115.9, 3240.9, 3491.4, 3757.7, and 3941.6 cm⁻¹. The average of 28 point WDS electron probe analyses performed on 7 crystals from Monte Nero is [wt% (range)]: MnO 41.62 (40.33–42.82), As_2O_5 43.35 (41.83–44.64), P_2O_5 0.82 (0.61–1.23), H_2O 15.69, total 100.09 wt%; the amount of H_2O was calculated on the basis of (As + P) = 2 apfu, charge balance and O = 12.5 apfu. The empirical formula of castellaroite is $Mn_{3.02}^{2+}(As_{1.94}P_{0.06})_{\Sigma 2.00}O_{12.5}H_{8.96}$ based on 12.5 O apfu. The strongest lines of the powder X-ray diffraction pattern are [d Å (I%; hkl)]: 10.90 (100; 011), 9.27 (67; 002), 6.97 (42; $\bar{1}$11), 3.323 (47; $\bar{2}$04,041,034,115), 3.043 (87; $\bar{1}$34,204,$\bar{2}$32), 2.656 (85; $\bar{3}$21,320,215,$\bar{2}$41,$\bar{2}$06), 2.165 (46; 400,315,$\bar{4}$02,161), 1.5589 (32; $\bar{4}$47,$\bar{4}$38,$\bar{2}$82,524). The unit-cell parameters refined from powder X-ray diffraction data are a = 8.733(4), b = 13.438(4), c = 18.643(4) Å, β = 95.006(11)°, and V = 2179.5 Å³. The crystal structure of castellaroite was solved by direct methods and re-

fined to $R_1 = 0.0118$ for 2513 independent $F_o > 4\sigma(F_o)$ reflections. The new mineral is monoclinic, $P2_1/n$, $a = 8.7565(8)$, $b = 13.4683(13)$, $c = 18.652(2)$ Å, $\beta = 94.876(7)°$, $V = 2191.7$ Å^3, $Z = 8$. In the crystal structure of castellaroite, Mn occupies five different octahedra and one MnO$_5$ square pyramid. Four types of Mn octahedra share common edges and form kinked chains parallel to [100]. The chains are linked by corner-sharing and form sheets parallel to {001}. All AsO$_4$ tetrahedra link with sheet octahedra through common corners and form a heteropolyhedral layer. The fifth Mn octahedra and square pyramids layers form edge-sharing dimers and are located between the heteropolyhedral layers. The dimers share corners with octahedra and As tetrahedra from adjacent layers and hence ling the layers in the [001] direction. The heteropolyhedral layer in the crystal structure of castellaroite is identical to those in the structures of several phosphates: angarfite, bakhchisaraitsevite, mejillonesite, metaswitzerite, rimkorolgite, and switzerite. However, castellaroite is the first arsenate with this type of the heteropolyhedral layer. The new mineral was named after Fabrizio Castellaro (b. 1970), an Italian mineral collector specializing in the minerals of Liguria. The holotype and one cotype from the Monte Nero mine are deposited in the collections of the Natural History Museum of Los Angeles County, Los Angeles, U.S.A. Two cotypes are deposited in the Dipartimento di Scienze della Terra of the Università di Torino stored in the Museo Regionale di Science Naturali di Torino, Sezione di Mineralogia, Petrografia e Geologia, Torino, Italy. **Yu.U.**

CHONGITE*

A.R. Kampf, B.P. Nash, M. Dini, and A.A. Molina Donoso (2016) Chongite, Ca$_3$Mg$_2$(AsO$_4$)$_2$(AsO$_3$OH)$_2$·4H$_2$O, a new arsenate member of the hureaulite group from the Torrecillas mine, Iquique Province, Chile. Mineralogical Magazine, 80(7), 1255–1263.

Chongite (IMA 2015-039), ideally Ca$_3$Mg$_2$(AsO$_4$)$_2$(AsO$_3$OH)$_2$·4H$_2$O, was discovered in the Torrecillas mine, located on Torrecillas Hill, Iquique Province, Tarapacá Region, Chile. Chongite was discovered in the Torrecillas deposit, which consists of two main veins intersecting metamorphosed marine shales and lavas and rich in secondary As and Cu minerals. These veins are related to the andesites and porphyritic lavas of the Jurassic La Negra Formation. Chongite is a secondary alteration phase and occurs in association with native arsenic, arsenolite, gajardoite, talmessite, and torrecillasite. The new mineral forms prismatic crystals up to ~1 mm long grouped in tightly intergrown radial aggregates up to 2 mm in diameter. These prisms are elongated on [001] and exhibit {100}, {110}, {111}, {11$\bar{1}$}, {20$\bar{1}$}, and {311} forms. No twinning was observed. Chongite is transparent, with a vitreous luster and white streak. The new mineral does not fluoresce in UV light. Mohs hardness is ~3½. It is brittle, has conchoidal fracture and a good cleavage on {100}. $D_{meas} = 3.09(2)$ g/cm^3; $D_{calc} = 3.087$ g/cm^3. Chongite is non-pleochroic, optically biaxial (–), $\alpha = 1.612$, $\beta = 1.626$, $\gamma = 1.635°$ (white light). $2V_{meas} = 76.9(1)°$; $2V_{calc} = 76.9°$; $X = \mathbf{b}$; $Z \wedge \mathbf{a} = 27°$ in the obtuse angle β. Dispersion of optical axes is distinct $r < v$. The mineral is slowly soluble in dilute HCl at room temperature. The averaged 12 point WDS electron probe analyses on 4 crystals is [wt% (range)]: CaO 19.96 (19.43–20.29), MgO 9.55 (9.32–9.96), MnO 1.18 (0.86–1.67), As$_2$O$_5$ 56.42 (56.09–57.04), H$_2$O 11.13 (was calculated on the basis of 4 apfu As, charge balance, and 20 O apfu), total 98.24. The empirical formula of chongite is (Ca$_{2.90}$Mg$_{1.93}$Mn$_{0.14}$)$_{\Sigma4.97}$As$_4$O$_{20}$H$_{10.07}$ based on 20 O apfu. The strongest lines of the powder X-ray diffraction pattern are [d Å (I%; hkl)]: 8.35 (29; 110), 4.644 (62; $\bar{3}$11,020,400,$\bar{2}$02), 4.396 (26; 311), 3.372 (62; 022,312,$\bar{5}$11), 3.275 (100; 420,$\bar{2}$22,$\bar{4}$21), 3.113 (57; 222), 2.384 (30; 711,530,$\bar{7}$12), 1.7990 (22; $\bar{9}$13,334,$\bar{5}$34). The unit cell parameters refined from powder X-ray diffraction data are $a = 18.580(11)$, $b = 9.357(11)$, $c = 9.957(11)$ Å, $\beta = 96.918(9)°$, and $V = 1718(3)$ Å^3. The crystal structure of chongite was solved by direct methods and refined

to $R = 1.78\%$. The new mineral is monoclinic, $C2/c$, $a = 18.5879(6)$, $b = 9.3660(3)$, $c = 9.9622(7)$ Å, $\beta = 96.916(7)°$, $V = 1721.75$ Å^3, $Z = 4$. In the crystal structure of chongite Ca and Mg occupy octahedra, which share common edges and form an edge sharing pentamer. These pentamers are linked into framework by sharing corners with other pentamers, and are linked by tetrahedral As as well. Chongite is isostructural with sainfeldite, miguelromeroite and villyaellenite, and can be considered a Mg-analogue of sainfeldite, Ca$_5$(AsO$_4$)$_2$(AsO$_3$OH)$_2$·4H$_2$O, in which Mg replaces Ca at the M(2) octahedral site. The new mineral was named after Guillermo Chong Díaz, a prominent Chilean geologist and academician. The holotype and two cotype specimens are deposited in the collections of the Natural History Museum of Los Angeles County, Los Angeles, U.S.A. **Yu.U.**

GAJARDOITE*

A.R. Kampf, B.P. Nash, M. Dini, and A.A. Molina Donoso (2016) Gajardoite, KCa$_{0.5}$As$_4^{3+}$O$_6$Cl$_2$·5H$_2$O, a new mineral related to lucabindiite and torrecillasite from the Torrecillas mine, Iquique Province, Chile. Mineralogical Magazine, 80(7), 1265–1272.

Gajardoite (IMA 2015-040), KCa$_{0.5}$As$_4^{3+}$O$_6$Cl$_2$·5H$_2$O, is a new mineral from the Torrecillas mine, Iquique Province, Chile (approximately 20°58′13″S, 70°8′17″W), where it occurs as a secondary alteration phase in association with native arsenic, arsenolite, chongite, talmessite, and torrecillasite. The Torrecillas deposit, in which the new mineral is found, consists of two main veins rich in secondary arsenic and copper minerals that intersect metamorphosed marine shales and lavas. These alteration minerals are interpreted as having formed from the oxidation of native arsenic and other As-bearing primary phases, followed by later alteration by saline fluids derived from evaporating meteoric water under hyperarid conditions. Gajardoite occurs as hexagonal plates, flattened on {001} and bounded by {100}, up to about 100 μm in diameter and 5 μm thick, in rosette-like subparallel intergrowths. No twinning is observed. Crystals are transparent, with vitreous luster and white streak. The mineral does not fluoresce in long- or short-wave UV light. Mohs hardness is 1½. The tenacity is brittle and the fracture is irregular. Cleavage is perfect on {001}. $D_{meas} = 2.64(2)$ g/cm^3; $D_{calc} = 2.676$ g/cm^3. The mineral is very slowly soluble in H$_2$O and slowly soluble in dilute HCl at room temperature. Gajardoite is non-pleochroic, optically uniaxial (–) with $\omega = 1.780(3)$ and $\varepsilon = 1.570(3)$ (white light). The average of electron probe WDS analysis (number of analyses not reported) [wt% (ranges)] is: Na$_2$O 0.26 (0.11–0.42), K$_2$O 6.13 (5.85–6.44), MgO 0.32 (0.20–0.43), CaO 6.67 (6.52–6.87), As$_2$O$_3$ 66.55 (62.44–68.49), Cl 11.66 (11.44–12.01), H$_2$O (on the basis of charge balance) 14.58, O=Cl –2.63, total 103.54. The empirical formula based on the 4 As apfu is: (K$_{0.77}$Ca$_{0.71}$Na$_{0.05}$Mg$_{0.05}$)$_{\Sigma1.58}$As$_4$O$_{11}$Cl$_{1.96}$H$_{9.62}$. The strongest lines of the X-ray powder diffraction pattern [d Å (I%; hkl)] are: 16.00 (100; 001), 5.31 (48; 003), 3.466 (31; 103), 3.013 (44; 104), 2.624 (51; 006,110,111), 2.353 (36; 113), 1.8647(21; 116,205) and 1.4605 (17; 119,303,216). The refined triclinic unit-cell parameters from these powder data are $a = 5.2592(10)$, $c = 15.971(4)$ Å, and $V = 382.56$ Å^3. The single-crystal unit-cell parameters are: $a = 5.2558(8)$, $c = 15.9666(18)$ Å, $V = 381.96$ Å^3, $Z = 1$, space group $P6/mmm$. The structure was refined to $R_1 = 0.035$ for 169 unique, observed [$F_o > 4\sigma F_o$] reflections. Gajardoite structure contains of two types of layers. One layer is made up of two neutral As$_2$O$_3$ sheets, between which are K$^+$ cations and outside of which are Cl$^-$ anions, with ideal layer composition KAs$_4^{3+}$O$_6$Cl$_2$; the As$_2$O$_3$ sheets are formed by AsO$_3$ pyramids connected by shared O atoms, which coordinate K$^+$ cations, while the apex of the pyramids are linked to the external Cl$^-$ atoms. The second layer type is built-up edge-sharing Ca(H$_2$O)$_6$ trigonal prisms, with a further H$_2$O at the center of the hexagonal cavities left in between; ideal composition of the layer is

$Ca(H_2O)_6 \cdot 4H_2O$. The structure of gajardoite is strongly related to the structure of lucabindiite, in particular for the $KAs_4^{3+}O_6Cl_2$ layer, and is similar but not identical to the structure of torrecillasite. The mineral name honors Anibal Gajardo Cubillos (b. 1945), a Chilean geologist with a long and distinguished career. The holotype and two cotype specimens that are deposited in the collections of the Natural History Museum of Los Angeles County, U.S.A. (catalogue numbers 65585, 65586, and 65587, respectively). These are the same as the holotype and cotypes for chongite. **F.C.**

JEFFBENITE*

F. Nestola, A.D. Burnham, L. Peruzzo, L. Tauro, M. Alvaro, M.J. Walter, M. Gunter, C. Anzolini, and S.C. Kohn (2016) Tetragonal almandine-pyrope phase, TAPP: finally, a name for it, the new mineral jeffbenite. Mineralogical Magazine, 80(7), 1219–1232.

Jeffbenite (IMA 2014-097), ideally $Mg_3Al_2Si_3O_{12}$, previously known as tetragonal-almandine-pyrope-phase (TAPP), is a new mineral species from an inclusion in an alluvial diamond from São Luiz river, Juina district of Mato Grosso, Brazil (11°29′S, 59°02′W). It forms part of a composite inclusion along with a grain of omphacitic pyroxene, with no crystallographic mutual relation either with the host diamond. Within the same diamond, an inclusion of $CaSiO_3$-walstromite was also found. Jeffbenite cannot be described in terms of morphology as it can be found only within diamond and thus it is not possible to observe its stable morphology. Jeffbenite is transparent, deep emerald green with the vitreous luster and white streak. It shows no fluorescence. Mohs hardness ~7. It is brittle with irregular fracture. $D_{calc} = 3.576$ g/cm³. It is optically uniaxial (–) with $\omega = 1.733(5)$ and $\varepsilon = 1.721(5)$ ($\lambda = 589$ nm). Micro-Raman spectroscopy (532 nm excitation laser) show five main peaks, in order of decreasing intensity, are (in cm⁻¹): 865, 926, 318, 995, and 499. Lower intensity peaks are evident in the 540–640 cm⁻¹ region, one peak is centered at 393 cm⁻¹, and three further peaks occur in the 200–300 cm⁻¹ region. The average of electron probe WDS analysis (number of data points not reported) [wt% (range)] is: SiO_2 41.74 (41.56–42.04), TiO_2 0.06 (0.04–0.07), Al_2O_3 23.84 (23.74–23.95), Cr_2O_3 2.86 (2.79–2.92), FeO_{total} 4.59 (4.55–4.62), FeO 3.65 (2.97–4.36), Fe_2O_3 (by charge balance) 0.93 (0.25–1.65), MnO 0.79 (0.75–0.85), MgO 25.16 (24.90–25.41), CaO 0.09 (0.08–0.10), Na_2O 0.10 (0.08–0.12), total 99.23 (98.66–99.55). The empirical formulae based on 12 O apfu is: $(Mg_{0.82}Fe^{3+}_{0.12})_{\Sigma 0.95}(Al_{1.86}Cr_{0.16})_{\Sigma 2.02}(Mg_{1.80}Fe^{2+}_{0.15}Mn_{0.05}Ca_{0.01}Na_{0.01})_{\Sigma 2.02}(Si_{2.82}Al_{0.18})_{\Sigma 3.00}O_{12}$. The strongest lines of the powder X-ray diffraction pattern [d Å (I%; hkl)] are: 2.647 (100; 204), 1.625 (44; 325), 2.881 (24; 211), 2.220 (19; 206), 1.390 (13; 424), 3.069 (11; 202), 2.056 (11; 224), 1.372 (11; 2.0.12). The parameters of the monoclinic unit-cell refined from the powder data are $a = 6.5355(2)$, $c = 18.1576(11)$ Å, and $V = 775.56$ Å³. The crystal structure of jeffbenite was refined with X-ray diffractions intensity data, collected on a single crystal with dimensions of $0.07 \times 0.05 \times 0.03$, to $R_{all} = 0.018$ on 1218 unique reflections. Unit-cell parameters obtained from single crystal are $a = 6.5231(1)$, $c = 18.1756(3)$ Å, $V = 773.38$ Å³, space group $I\bar{4}2d$. The crystal structure of jeffbenite comprises five different cation positions: T1 and T2, which are two symmetrically independent tetrahedral sites; M2 and M3 which are two significantly different octahedral sites; and the M1 site which represents by a capped tetrahedron. The M1 site is dominated by Mg, M2 dominated by Al, M3 dominated by Mg, and both T1 and T2 almost fully occupied by Si. The name is in honor of two scientists, Jeffrey W. Harris (School of Geographical and Earth Sciences, University of Glasgow, U.K.; b. 1940) and Ben Harte (School of Geosciences, University of Edinburgh, U.K.; b. 1941), whose work on diamonds, and super-deep diamonds in particular, has shaped the understanding of mantle geochemical processes. The holotype is deposited at the Museum of Mineralogy of the University of Padova under the catalogue number MMP M12660. **F.C.**

LUCCHESIITE*

F. Bosi, H. Skogby, M.E. Ciriotti, P. Gadas, M. Novák, J. Cempírek, D. Všianský, and J. Filip (2017) Lucchesiite, $CaFe^{2+}_3Al_6(Si_6O_{18})(BO_3)_3(OH)_3O$, a new mineral species of the tourmaline supergroup. Mineralogical Magazine, Mineralogical Magazine, 81(1), 1–14.

P. Gadas, M. Novák, J. Cempírek, J. Filip, M. Vašinová Galiová, L.A. Groat, and D. Všianský (2014) Mineral assemblages, compositional variation, and crystal structure of feruvitic tourmaline from a contaminated anatectic pegmatite at Mirošov near Strážek, Moldanubian Zone, Czech Republic. Canadian Mineralogist, 52, 285–301.

Lucchesiite (IMA 2015-043), ideally $CaFe^{2+}_3Al_6(Si_6O_{18})(BO_3)_3(OH)_3O$, is a new mineral species of the tourmaline supergroup found in two different localities. One locality are the alluvial deposits in gem-bearing river gravels ("illam") at Ratnapura, Sri Lanka (6°35′N, 80°35′E), most probably associated with pegmatites, which not necessarily occur close to the collecting area. The other locality is an anatectic pegmatite from Mirošov near Strážek, western Moravia, Czech Republic (49°27′49.38″N, 16°9′54.34″E), where it occurs as graphic intergrowths of Ca-rich schorl to Na-rich lucchesiite with quartz, in the central parts of the pegmatite. At Mirošov, along with the previous type occurrence, tourmaline also occurs in other two textural-paragenetic forms: interstitial Ca-rich schorl-dravite to Na-Mg-rich feruvite in an outer granitic unit, and volumetrically subordinate Ca-rich dravite replacing occasionally both previous forms of tourmaline. Other minerals associated are major plagioclase ($An_{30–42}$), quartz, K-feldspar, and minor amphibole. The Sri Lanka specimen shows anhedral habitus (up to ~5 mm), as a broken part of a columnar crystal, whereas that from the Czech Republic forms graphic intergrowths with quartz in large aggregates up to 5 cm. Lucchesiite is black with a vitreous luster. It has a gray streak and shows no fluorescence. Mohs hardness ~7. It is brittle with a conchoidal fracture. $D_{calc} = 3.209$ g/cm³ (Sri Lanka) and $D_{calc} = 3.243$ g/cm³ (Czech Republic). In transmitted light lucchesiite is transparent, pleochroic with $O =$ very dark brown and $E =$ light brown (Sri Lanka), and $O =$ opaque and $E =$ dark brown (Czech Republic). It is optically uniaxial (–), $\omega = 1.670(5)$, $\varepsilon = 1.655(5)$ (white light) (Sri Lanka); ω was not measured and $\varepsilon = 1.656(6)$ ($\lambda = 589.9$ nm) (Czech Republic). FTIR spectroscopy of the sample from Sri Lanka show an intense band around 3570 cm⁻¹ and some very weak bands at 3710–3760 cm⁻¹, all strongly polarized in the c axis direction, and the lack of any significant bands above ca. 3650 cm⁻¹ [the region where bands due to (OH) at the W position are expected]. The average of 10 (Sri Lanka) and 5 (Czech Republic) electron probe WDS analysis [wt% (range) Sri Lanka/*wt% (range) Czech Republic*] is: SiO_2 34.03 (33.62–34.24)/*33.46 (33.13–33.75)*, TiO_2 2.53 (2.49–2.61)/*0.64 (0.62–0.65)*, B_2O_3 (by stoichiometry) 10.11/*9.89*, Al_2O_3 26.48 (26.17–26.82)/*27.00 (26.68–27.19)*, V_2O_3 0.12 (0.11–0.16)/*b.d.l.*, FeO_{tot} 11.77 (11.54–11.93)/*16.82 (16.64–17.02)*, Fe_2O_3 (by Mössbauer) 1.97/*10.05*, FeO (by Mössbauer) 10.00/*7.77*, MgO 6.73 (6.67–6.95)/*3.59 (3.51–3.64)*, MnO 0.05 (0–0.09)/*0.20 (0.18–0.22)*, ZnO 0.10 (0–0.21)/*0.04 (0–0.08)*, CaO 3.74 (3.61–3.82)/*2.62 (2.59–2.70)*, Na_2O 0.89 (0.92–0.84)/*1.32 (1.28–1.37)*, K_2O 0.09 (0.07–0.11)/*0.06 (0.04–0.07)*, F 0.44(0.34–0.57)/*0.10 (0.09–0.12)*, H_2O (by stoichiometry) 2.67/*2.27*, –O=F –0.19/*–0.04*, total 99.76/*98.96*. Lucchesiite from the Czech Republic has very low Li 16-17 ppm, so it was assumed insignificant in both samples. The empirical formulae based on 31 (O+OH+F) apfu are: $^X(Ca_{0.69}Na_{0.30}K_{0.02})_{\Sigma 1.01}{}^Y(Fe^{2+}_{1.44}Mg_{0.72}Al_{0.48}Ti^{4+}_{0.33}V^{3+}_{0.02}Mn_{0.01}Zn_{0.01})_{\Sigma 3.00}{}^Z(Al_{4.74}Mg_{1.01}Fe^{3+}_{0.25})_{\Sigma 6.00}[^T(Si_{5.85}Al_{0.15})_{\Sigma 6.00}O_{18}](BO_3)_3{}^V(OH)_3{}^W[O_{0.69}F_{0.24}(OH)_{0.07}]_{\Sigma 1.00}$ (Sri Lanka) and $^X(Ca_{0.49}Na_{0.45}{}_{0.05}K_{0.01})_{\Sigma 1.00}{}^Y(Fe^{2+}_{1.14}Fe^{3+}_{0.95}Mg_{0.42}Al_{0.37}Mn_{0.03}Ti^{4+}_{0.08}Zn_{0.01})_{\Sigma 3.00}{}^Z(Al_{5.11}Fe^{3+}_{0.38}Mg_{0.52})_{\Sigma 6.00}[^T(Si_{5.88}Al_{0.12})_{\Sigma 6.00}O_{18}](BO_3)_3{}^V[(OH)_{2.66}O_{0.34}]_{\Sigma 3.00}{}^W(O_{0.94}F_{0.06})_{\Sigma 1.00}$ (Czech Republic). The strongest lines of the powder X-ray diffraction pattern [d Å (I%; hkl) Sri Lanka/*Czech Republic*] are: 6.390/*6.424* (24/*53*; 101), 4.236/*4.249* (42/*41*; 211), 3.490/*3.503* (72/*100*; 012), 2.970/*2.979* (99/*100*; 122), 2.587/*2.591*

(100/*84*; 051), 2.049/*2.053* (69/*49*; 152), 1.926/*1.930* (43/*17*; 342), and 1.512/*1.516* (42/*16*; 054). The parameters of the unit-cell refined from the powder data are $a = 16.006(3)$, $c = 7.2136(2)$ Å, and $V = 1599.39$ Å^3 (Sri Lanka) and $a = 16.0159(2)$, $c = 7.2363(1)$ Å, and $V = 1607.48$ Å^3 (Czech Republic). The crystal structure of lucchesiite was refined with X-ray diffractions intensity data, collected on single crystals with dimensions of $0.13 \times 0.20 \times 0.21$ (Sri Lanka) and of $0.07 \times 0.07 \times 0.05$ (Czech Republic), to $R_1 = 0.015$ and $R_1 = 0.016$ based on 2244 and 1725 unique $I > 2\sigma(I)$ reflections, respectively. Unit-cell parameters obtained from a single crystal are $a = 16.0018(7)$, $c = 7.2149(3)$ Å, $V = 1599.92(15)$ Å^3 (Sri Lanka) and $a = 16.0047(4)$, $c = 7.2120(2)$ Å, $V = 1599.86$ Å^3, space group $R3m$. Lucchesiite is an oxy-species belonging to the calcic group of the tourmaline supergroup (Henry et al. 2011). The closest end-member composition of a valid tourmaline species is that of feruvite, to which lucchesiite is ideally related by the heterovalent coupled substitution $^Z Al^{3+} + {}^{O1}O^{2-} \leftrightarrow {}^Z Mg^{2+} + {}^{O1}(OH)^{1-}$. The species is named after the late Sergio Lucchesi (1958–2010), professor of mineralogy at Sapienza University of Rome (Italy), to honor his contribution to the study of tourmaline and spinel crystal chemistry. Two specimens of lucchesiite have been deposited: (1) the holotype specimen from Sri Lanka in the Museum of Mineralogy, Earth Sciences Department, Sapienza University of Rome, Italy, and the cotype specimen from Czech Republic in the Moravian Museum, Department of Mineralogy and Petrography, Brno, Czech Republic (catalogue numbers A11137, polished section with crystal used for the structure refinement, and A11138 source sample). **F.C.**

Reference cited

Henry, D.J., Novák, M., Hawthorne, F.C., Ertl, A., Dutrow, B., Uher, P., and Pezzotta, F. (2011) Nomenclature of the tourmaline supergroup minerals. American Mineralogist, 96, 895–913.

Tvrdýite*

J. Sejkora, I.E. Grey, A.R. Kampf, J.R. Price, and J. Čejka (2016) Tvrdýite, $Fe^{2+}Fe_2^{3+}Al_3(PO_4)_4(OH)_5(OH_2)_4 \cdot 2H_2O$, a new phosphate mineral from Krásno near Horní Slavkov, Czech Republic. Mineralogical Magazine, 80(6), 1077–1088.

Tvrdýite (IMA 2014-082), ideally $Fe^{2+}Fe_2^{3+}Al_3(PO_4)_4(OH)_5(OH_2)_4 \cdot 2H_2O$, is a new phosphate mineral coming from the abandoned Huber open pit, in the Krásno ore district near Horní Slavkov, western Bohemia, Czech Republic (50°07′22″N 12°48′2″E). The Huber stock, in the past mined for Sn and W, is a greisen that contains quartz bodies with disseminated cassiterite, wolframite, sulfides, and phosphates. Tvrdýite was found in a cavity in quartz gangue in association with older, greenish brown, Al-rich [1–1.5 atoms per formula unit (apfu) Al] beraunite, $Fe^{2+}Fe_3^{3+}(PO_4)_4(OH)_5 (OH_2)_4 \cdot 2H_2O$, fluorapatite and pharmacosiderite. It is a late hydrothermal or supergene mineral formed from the breakdown of primary triplite (in association with isokite and fluorapatite) in contact with acidic waters. Tvrdýite forms acicular to fibrous crystals with diameters in the range 0.5–5 μm and lengths up to 300 μm, partly grouped in radiating aggregates up to 3 mm in size. Aggregates are silvery to olive grayish green with a pearly luster and a light olive-green streak, and are very brittle, although individual fibers are somewhat flexible. Cleavage is good on {100}. Mohs hardness is estimated to be 3–4 by analogy with beraunite. Density measurements were not undertaken due to paucity of the pure material and its fibrous nature. $D_{calc} = 2.834$ g/cm^3. It is non-fluorescent under short-wave or long-wave UV radiation. Tvrdýite is optically biaxial (–), $\alpha = 1.650(2)$, $\beta = 1.671$, $\gamma = 1.677$ (white light), $2V_{meas} = 56(1)°$, $2V_{calc} = 56°$; $Z = \mathbf{b}$, $X \approx \mathbf{a}$, $Y \approx \mathbf{c}$. Dispersion of optical axes is strong $r > v$. Tvrdýite is pleochroic with X = greenish blue, Y = yellowish orange, Z = yellowish orange ($X \gg Y > Z$). The infrared vibrational spectrum of tvrdýite shows main bands (cm^{-1}) at 3610 (ν OH stretching vibrations of hydroxyl ions), 3394, 3255 (ν OH stretching vibrations of symmetrically distinct hydrogen-bonded water molecules), 1631 [H_2O $ν_2$ (δ) bending vibrations], 1191, 1058 [$ν_3$ $(PO_4)^{3-}$ antisymmetric stretching vibrations], 1017, 994 [$ν_1$ $(PO_4)^{3-}$ symmetric stretching vibrations], 936, 843 (δM–OH bending vibrations), 613 and 485 [$ν_4$ (δ) $(PO_4)^{3-}$ and $ν_2$ (δ) $(PO_4)^{3-}$ bending vibrations]. Raman spectrum (532 nm laser) shows bands at (cm^{-1}) at 1623, 1194, 1102, 1023, 860, 698, 637, 586, 496, 415, 303, 281, 233, and 143. The average of 9 electron probe WDS analyses is [wt% (range)]: MnO 0.01 (0–0.06), ZnO 5.08 (4.56–5.45), total Fe as FeO 23.35 (22.75–24.42), FeO (on the basis of bond-valence calculations) 4.31, Fe_2O_3 (on the basis of bond-valence calculations) 21.16, Al_2O_3 16.71 (15.6–17.3), P_2O_5 32.64 (32.1–33.0), As_2O_5 2.56 (2.19–3.01), F 0.53 (0.45–0.58), H_2O (on the basis of 17 H apfu) 17.84, O=F –0.22, total 100.62. The empirical formula calculated on the basis of 27 (O+F) apfu is: $Zn_{0.52}Fe^{2+}_{0.50}Fe^{3+}_{2.21}Al_{2.75}(PO_4)_{3.86}(AsO_4)_{0.19} (OH)_{4.60}F_{0.23}(OH_2)_4 \cdot 2H_2O$. The eight strongest lines of the X-ray powder pattern [d Å (I%; hkl)] are: 10.227 (100; 200), 9.400 (6; 002), 7.156 (14; 20$\bar{2}$), 5.120 (7; $\bar{4}$00), 3.416 (11; 600), 3.278 (6; 60$\bar{2}$), 2.562 (5; 800), and 2.0511 (3; $\bar{1}$0.0.0). The unit-cell parameters refined from the powder data are $a = 20.543(2)$, $b = 5.101(1)$, $c = 18.877(4)$ Å, $\beta = 93.64(1)°$, $V = 1974.1$ Å^3. The crystal structure was refined with X-ray diffractions intensity data, collected on a fiber with dimensions of $0.005 \times 0.005 \times 0.05$, to $R_{all} = 0.038$ on 2276 observed reflections with $I > 2\sigma(I)$. Unit-cell parameters obtained from single crystal are $a = 20.564(4)$, $b = 5.1010(10)$, $c = 18.883(4)$ Å, $\beta = 93.68(3)°$, $V = 1976.7$ Å^3, space group $C2/c$, $Z = 4$. Tvrdýite is isostructural with beraunite, but contains dominant Al in two (M2 and M3) of the four independent M sites, which are all occupied by Fe in beraunite. The site M1 contains equal parts of Fe^{2+} and Fe^{3+} (on the basis of bond valence calculations). The positions of all nine expected H atoms based on previous studies was observed in a difference-Fourier synthesis. The new mineral honors the Czech mineralogist and geologist Jaromír Tvrdý (b. 1959) from Liberec, northern Bohemia, Czech Republic, for his contributions to mineralogy and economic geology. The holotype specimen (one sample 5 cm × 4 cm × 2 cm) is deposited in the Department of Mineralogy and Petrology of the National Museum in Prague, Czech Republic, catalogue number P1P 11/2014. Parts of the holotype are also deposited at Museum Victoria, Melbourne, Australia, specimen number M53361, and in the Natural History Museum of Los Angeles County, Los Angeles, U.S.A., catalogue number 65560. **F.C.**