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New Mineral Names*†

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This New Mineral Names has entries for 23 new minerals, including alpeite, ammoniozippeite, batagayitite, centennialite, dagnaisite, davidsmithite, epifanovite, ferro-tschermakite, gre nilizaridite, grotfeontinite, janchevite, javorieite, kampelite, roymillerite, tredouxite, vanadio-pargasite, and wilancookite. Included also is a series of pyrochlore supergroup minerals: fluorcalcipyrochlore, hydroxycalcicmicrolite, hydroxyferroméite, hydroxykenoelsmoreite, hydroxynatropyrochlore, oxynatromicrolite along with a new data on hydrokenoelsmoreite-3C and hydrokenoelsmoreite-6R.

ALPEITE*

A.R. Kampf, C. Carbone, D. Belmonte, B.P. Nash, L. Chiappino, and F. Castellaro (2017) Alpeite, Ca3Mn2[(Mn4+Mg)Si4O10](OH)2, a new ardennite-group mineral from Italy. European Journal of Mineralogy, 29(5), 907–914.

Alpeite (IMA 2016-072), ideally Ca3Mn2[(Mn4+Mg)Si4O10](OH)2, orthorhombic, is a new member of the ardennite group from the Monte Alpe mine (44°18′24″N, 9°32′00″E), Liguria, Italy. It crystal-lized from V- and Mn-rich hydrothermal fluids in an oxidizing environment. Alpeite is associated with bruniante, dolomite, quartz, tordorokite, and ganophyllite. Alpeite occurs as intergrowths of plates up to ~0.3 mm in diameter, which are flattened on {100} and exhibit the forms {100}, {001}, and {102}. No twinning was observed. Crystals are brownish-red and transparent with a vitreous luster and beige streak. Crystals are brittle with a curved and stepped fracture. The cleavage is perfect on {100} and good on {010} and {001}. The mineral is non-fluorescent. Optically it is biaxial (--), α = 1.747(3), β = 1.785(3), γ = 1.808(3) (white light); 2Vmes = 73(2)° (spindle stage); 2Vcav = 74.3°; dispersion of optical axes is r > v, strong; X = a, Y = b, Z = c. The pleochroism in shades of reddish brown is Y > Z > X. The Mohs hardness is 5½–6. The density was not measured because frag-ments are nearly invisible in Clerici solution. Dcalc = 3.374 g/cm³. The mineral is inert in concentrated HCl at room temperature. The average of 14 electron probe WDS analyses in 8 crystals is [wt% (range)]: CaO 20.45 (19.99–20.67), MgO 2.49 (2.41–2.82), CoO 1.43 (0.91–1.98), MnO 20.90 (20.17–21.84) (MnO1.08 and MnO1.70 according to site occupancies), Al2O3 11.52 (10.56–12.02), SiO2 9.29 (28.63–30.74), V2O5 7.36 (5.50–8.51), H2O 5.13 (on the basis of charge balance), total 99.08. The empirical formula (Cac0.98Mn0.02)3+2Mn4+0.04(Tio.00Co0.01)2O10(Si4.00O10)(OH)2 based on 28 O pfu. The strongest lines in the X-ray powder-diffraction pattern [d Å (P; hkl)] are: 3.022 (93; 115), 2.673 (100; 116), 2.572 (69; 206), 2.512 (83; 040). The unit-cell parameters refined from powder-diffraction data are: a = 8.9394(12), b = 6.0488(8), c = 18.954(3) Å, V = 1024.9 Å³. The single-crystal X-ray data obtained from the crystal of 0.07 × 0.04 × 0.005 mm in size shows that alpeite is orthorhombic, Pnmm, a = 8.9421(11), b = 6.053(6), c = 18.978(6) Å, V = 1027.29 Å³, Z = 2. The crystal structure of alpeite, refined to R1 = 4.4 % for 834 unique observed reflections with Fh0 > 4σ(Fh0), and 5.39% for all 1022 reflections.

*All minerals marked with an asterisk have been approved by the IMA CNMCC.
†For a complete listing of all IMA-validated unnamed minerals and their codes, see http://pubsites.uws.edu.au/ima-cnmcc/.

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New Mineral Names*†

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AMMONIOZIPPEITE*


Ammoniozippeite (IMA 2017-017), ideally (NH4)2[(UO2)4(SO4)3]·H2O, orthorhombic, is a new mineral discovered in the Blue Lizard Mine, San Juan County, Utah (37°33′26″N 110°17′44″W), and the Burro Mine, San Miguel County, Colorado, U.S.A. (38°24′2″N 108°53′23″W). It was also found at Green Lizard Mine, and a map showing-Giveaway-Simplon deposits near the Blue Lizard mine. At all locations it occurs as a low-temperature, secondary phase resulted from postmining oxidation of primary U ore in the humid underground environment. Ore minerals were deposited as replacement of wood and other organic material and as disseminations in the enclosing sandstone. At the Blue Lizard ammoniozippeite associated with a wide variety of other secondary phases including biödite, bobcookitite, brochanite, chalcantite, devilline, dickite, ferrinitrate, gerhardite, gyspum, johannite, krönkite, magnesiozippeite, natrozipeite, pentahydrate, pickeringite, plášilite, posnjakite, redcanyonite, wetherilite, and other potentially new uranyl sulfates (under study). At the Burro mine ammoniozippeite is rare and occurs on a matrix consisting of asphaltum, quartz, and calcite, associating with gypsum, natrojarosite, and natrozipeite. Ammoniozippeite crystals are acicular to bladed, usually tapering to a point up to 0.2 mm (Blue Lizard), or with rectangular (square) terminations up to ~2 mm (Burro mine). Crystals from the Blue Lizard mine are elongated on {100}; those from the Burro mine are flattened on {001} and have simple rectangular morphology with the forms {010} and {100}. Those from the Blue Lizard mine are flattened on {010}, often have a lozengeshape with spear-like terminations and exhibit forms {001} and various combinations of {101}, {102}, {103}, and {104}. Ammoniozippeite is yellow to yellowish orange, transparent, with a pale-yellow streak and vitreous luster. It fluoresces dull green-yellow under 405 nm laser light. The cleavage is same as that of other members of the ardennite group. It contains chains of edge-sharing Mn³⁺ and Al octahedra extending along the b axis, which are linked into a framework by sharing corners with SiO4 tetrahedra and with SiO4 tetrahedral groups. Within the cavities in this framework are sevenfold-coordinated Ca sites. In the structure of alpeite, Mn⁴⁺ is the dominant cation in the M1 sites, while in all other members of the ardenrite group [ardennite-(As), ardenrite-(V), and kannanite], Al is the dominant cation in both these sites. Alpeite is named for its type locality. The holotype specimen deposited in the Natural History Museum of Los Angeles County, California, U.S.A. F.C.
a new phosphate mineral from Kester tin deposit (Yakutia, Russia): occurrence and crystal structure. Mineralogy and Petrology, 112(4), 591–601.

Batagayite (IMA 2017-002), CaZn2(Zn, Cu)(PO4)3(PO3OH), 12H2O, monoclinic, is a new mineral discovered at the greisen-type Sn–Ta deposit of Kester, Kuzhir–Ymykh-Khai massif, NE Yakutia, Russia. It was found in a quartz-phosphate nest of ~5 m in diameter within greisenized cassiterite-bearing granodiorite. The nest consists of pale-gray botryoidal aggregates of fluorapatite (up to 30 cm) and porous milky-white aggregates of quartz (up to 10 cm). The numerous voids and fractures in these aggregates are incrusted by dark-green crystals and sphene and spherulites (up to 5 mm) of pseudomalachite and light blue sampleite, druses of pale-green long-prismatic crystals of latheline (up to 7 mm), and separated clusters of native copper (up to 3 mm). Radial aggregates of colorless flattened-prismatic crystals of batagayite (up to 2 mm) grow on the surface of copper clusters closely associated with colorless cubo-octahedral arsenoselite (up to 1 mm), colorless tetragonal plates of tobermorite (up to 1 mm), turquoise-blue crusts (up to 50 μm thick) of recently discovered here epifanoivite NaCaCu2(PO3)(Al2O(OH)), 7H2O (monoclinic) (Yakovchenkuk et al. 2017) and radial fibrous aggregates (up to 3 mm) of unknown mineral. Other associated minerals are Na-analog of batagayite and Mg-analog of hopeite. Batagayite is a secondary low-temperature mineral formed as a result of alteration of primary minerals such as native copper and fluorapatite. Batagayite blades are flattened on {001} and elongated on {100} and often form radial aggregates. The streak is white, and the luster is vitreous. The mineral has a perfect cleavage on {001} with no parting observed. It is brittle with Mohs hardness of 3; Dcalc = 3.02 g/cm³. The mineral easily dissolves in 10% room-temperature HCl. Batagayite is non-pleochroic, optically biaxial (-), α = 1.566(2), β = 1.572(2), γ = 1.573(2) (589 nm), 2V = 40(5)°, 2V calc = 44.3°; Z ¼ 001, further details unclear. No dispersion (unspecified kind) were observed. The most intensive bands of the Raman spectrum (cm⁻¹) are: 1009, 993, 958, 942, and 926 (with shoulder at 912) correspond to the symmetric and antisymmetric stretching modes of the PO4³⁻; 440, 462 (bending vibrations of the same bonds), the high-frequency bands can be related to PO4 groups coordinated by H2O. Other bands in the range 1100–1150 can be attributed to the antisymmetric stretching vibrations ν of the PO4³⁻. Bands at 90, 110, 131, 157, 238, 271, 375 (weak), 525, and 570 are assigned to the different vibration modes of the Zn–O and Cu–O bonds. The broad bands in the range 3200–3600 are attributed to stretching vibrations of the O–H bonds of H2O and hydroxy groups. The average of 12 electron probe WDS analyses on 2 crystals [wt% (range)] is: NaO 0.13 (0.04–0.14), 0.19 (0.05–0.33), K2O = -0.43 (0.36–0.51), SO3 = 11.45 (10.80–12.44), V = 110.0 (10.61–11.37), UO2: 81.10 (79.24–84.24)/H2O: 1120 (shoulder at 1138), 1065 (split triply degenerate), SO3°antisymmetric stretching), 1098, 1120 (split triply degenerate) SO3°antisymmetric stretching), 1013 (vib SO3° symmetric stretching), 849(4, 8264, 8068 (vib SO3° symmetric stretching), 664w, 608w (split doubly degenerate), 598w, 581m, 406s (split doubly degenerate), 509m, 381m [vib U-O(PO4) antisymmetric stretching], may coincide with the vOH of interlayer NH4 as at 283, 268ah, 313m, 230m [vib U–O–U bending or U–O–ligand stretching], 148s (external lattice modes and UO3° translations and rotations). The averages of electron microprobe WDS analyses (five on four crystals from Burro mine / four on three crystals from Blue Lizard) are [wt% (range)]: (NH4)2O 7.29 (6.96–7.76)/H2O: 7.36 (6.88–7.74), NaO 0.13 (0.04–0.14), 0.19 (0.05–0.33), K2O = -0.43 (0.36–0.51), SO3 = 11.45 (10.80–12.44), V = 110.0 (10.61–11.37), UO2: 81.10 (79.24–84.24)/H2O: 1120 (shoulder at 1138), 1065 (split triply degenerate), SO3°antisymmetric stretching), 1098, 1120 (split triply degenerate) SO3°antisymmetric stretching), 1013 (vib SO3° symmetric stretching), 849(4, 8264, 8068 (vib SO3° symmetric stretching), 664w, 608w (split doubly degenerate), 598w, 581m, 406s (split doubly degenerate), 509m, 381m [vib U-O(PO4) antisymmetric stretching], may coincide with the vOH of interlayer NH4 as at 283, 268ah, 313m, 230m [vib U–O–U bending or U–O–ligand stretching], 148s (external lattice modes and UO3° translations and rotations). The empirical formula based on P+7Si = 7(Zn2Cu2CaCu2(PO4)3(PO3OH), 12H2O (korshikovite) (Zn2Cu2CaCu2(PO4)3(PO3OH), 12H2O, 12H2O. The synthetic analogs of ammoniozippeite contains two fully occupied N sites and no H2O in the interlayer (Burns et al. 2003). The structure of that phase (NH4)2Zn(PO4)(SO4)2 refined in the space group Cmca. The non-standard space group Cmca chosen for ammoniozippeite to be consistent with the cells of the monoclinic zippeite-group minerals. However, zippeite group has not yet been formally approved by the ICBNM. The name reflects the fact that this mineral is the ammonium analog of zippeite, where NH4 replaces K⁺. One holotype (Burro mine) and one octotype (Blue Lizard mine) are deposited in the Natural History Museum of Los Angeles County, Los Angeles, California, U.S.A. D.B.

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which share corners to form 4-membered rings further linked via (PO₃OH) tetrahedra into chains parallel to a. The CuO₆ octahedra are located between the chains. The interlayer space is occupied by the Ca⁺⁺ cations and H₂O molecules. High hydration state and the modular character of the batagayite structure resulted in a high structural complexity (1058.257 bits/cell). The mineral is named for a small town of Batagay (administrative center of the Verkhoyansk ulus of the Sakha Republic) located in ~50 km from the deposit. The holotype specimen is deposited in the Mineralogical Museum of St. Petersburg University, Russia. D.B.

Reference cited


Centennialite (IMA 2013-110), CaCu₅(PO₄)Cl·0.7H₂O, trigonal, is a new mineral discovered at the Centennial Mine of the Lake Superior copper district, Houghton Co., Michigan, U.S.A. (47°15′30″N, 88°25′43″W) and named for its type location. It occurs as a secondary product resulted from acid water reaction with unspecified supergene Cu mineralization (mineralogy and geological setting are given in Heinrich and Robinson 2004) and intimately mixed with the minerals of calumetite Cu(OH)Cl·2H₂O and atacamite Cu₄(OH)₆Cl₂ families which are essentially indivisible from centennialite. Its chemistry and association are identical to that of the “Unidentified Cu–Ca–Cl Mineral,” which has been noted at various mines in the district; e.g., Ahmeek, Quincy, White Pine, Mohawk, Franklin Jr., and Centennial mines (Brandes and Robinson 2002; Heinrich and Robinson 2004). The study is based on three specimens further considered as cotypes. Original cotype 1 specimen, purchased as calumetite, represented by single agglomerations up to 0.5 mm of detached botryoidal encrustations in and on wall-rock consisted of centennialite, calumetite and clinoatacamite Cotype 3 is the specimen 14073 of the Musée de Minéralogie, Paris, France, and the Mineral Museum of the University of Arizona, Tucson, U.S.A., where given catalogues numbers are 83080 and 19588, respectively. Cotype 2 is the specimen 8789 from University of Arizona Museum labeled as “Calumetite,” from 800’ level of Centennial Mine (S. Williams specimen received by the Museum in 1964). It is 50 × 25 × 20 mm specimen represented by chalky pale-blue encrustations in and on wall-rock consisted of centennialite, calumetite and clinoatacamite Cotype 3 is the specimen 14073 of the Musée de Minéralogie, Paris (type specimen for calumetite) from the same specific location labeled as “Calumetite” (exchanged with S. Williams in 1963). It consists of several millimeter-sized irregular encrusted pieces with pale and powder blue regions of centennialite-bearing calumetite. Pale blue parts tend to be centennialite richer. It also contains some paratacamite and powder blue regions of centennialite-bearing calumetite. Pale blue parts tend to be centennialite richer. It also contains some paratacamite and pseudobeelite. No other macroscopic characterization provided as well as density and optical properties due to the nature of the material. The portion of centum from cotype 2 heated to 165 °C appeared to be converted to one of a near-clean centennialite-like compound. Due to the size and heterogeneity of the natural specimens, presence of absorbed water, etc. IR and thermogravimetric study seemed not to be useful and only qualitative and comparative EDS electron probe analyses were performed on natural materials using an area scans to minimize a beam damage. The results for three scan areas on each of three cotypes (wt% ranges for cotypes 1/2/3) are Al 0.0/0.0–0.04/0.06; Si 0.0/0.0–0.04/0.06; Ca 9.8–10.0/9.8–10.2/3.4–8.9; Cu 28.8–29.0/29.1–29.2/30.4–30.6; Cl 21.2–21.3/21.2–21.6/21.9/19.1–23.0; Ω 39.4–39.5/39.1–39.2/39.5–40.7. The atomic ratio Ca:Cu:Cl = 1:3:2 for all

three cotypes. As more accurate data pertaining specifically to centennialite was not obtained on the natural samples, analyses were also performed on synthetic material with X-ray control to ensure the phase analyzed is identical to both centennialite and its synthetic analog (Erdös et al. 1981). A combination of combustion analysis, ion chromatography, inductively coupled plasmamass spectrometry and inductively coupled plasma atomic emission spectroscopy analyses resulted as (wt%): Ca 10.1, Cu 44.3, Cl 16.9, O 24.2, H 1.91, total 97.41. The empirical formula based on 2 Cl pfu, with OH and H₂O partitioned according to H content and charge balance is Ca₉CuₓCl₅(OH)₆ClₓHₜₓO. Based on water content obtained here, and the structural studies of cotype 1 and cotype 3, the formula for centennialite is Ca₉Cuₓ(OH)₆Clₓ·nH₂O, where n ~ 0.7. The strongest lines in the X-ray powder diffraction pattern are [d Å (hkl); relative intensity]: 5.799 (100; 001), 2.583 (75; 201), 2.886 (51; 111), 1.665 (20; 220), 1.605 (17; 023), 1.600 (15; 221), 1.444 (11; 222). The unit-cell parameters are a = 6.6606(9) Å, c = 5.8004(8) Å, V = 222.85 Å³. The crystal structure refinement obtained by Rietveld (R = 5.99%) with additional H location by repulsion methods shows the mineral is trigonal, a = 6.6615(1), c = 5.8022(2) Å, V = 222.98 Å³; P3₁m1, Z = 1; Dcalc = 3.100 g/cm³. The structure has a kapellasite-like topology. The layers consisting of triangular network of edge-sharing CaO₆ octahedra alternating with edge-sharing planar CuO₆(H₄) units such way that each CaO₆ octahedron is surrounded by 6 rectangular CuO₆(H₄) units. All 0 site are protonated and bridge Ca and Cu sites. These Ca-Cu–polyhedral layers are stacked, along [001], with two hydrogen-bonded Cl sites between them. These extend the coordination of the Ca-site to eightfold-fold, akin to the body-diagonal Pb–Cu sheet in morduchite PbCuO₆. The relationship between calumetite and centennialite is discussed and a substructure model is proposed for a synthetic calumetite-like phase directly related to centennialite. D.B.

References cited


Dagenaisite (IMA 2017-017), ideally Zn₆Te₆O₁₈, monoclinic, is a new mineral from the 300 foot level of the Ophonsha stope at Gold Chain mine, Tintic district, Juab County, Utah, U.S.A. (39°55′44″N; 112°50′W). The mine exploited a polymetallic (Au–Ag–Cu–Pb–Zn) vein deposit in dolomite. The upper portion of the deposit is almost completely oxidized. Dagenaisite was found with cinnabar, dugganite, eurekadumpite, and gold in vugs in a quartz dolomite matrix. Other minerals of the general assemblage include adamite, arseniosiderite, atelestite, baryte, beardite, conichalcite, hemimorphite, kettnerite, malachite, mimetite, mixite, olivenite, and rosasite. Dagenaisite formed at a late stage of oxidation and occurs as tiny light greenish-gray platelets with hexagonal outlines (up to 100 μm but generally smaller and less than 1 mm thick), usually intermixed with amorphous material, forming porous masses that are apparently replacements of earlier Te- and Zn-bearing minerals, probably hessite and sphalerite. The crystals are translucent to translucent with a white streak, pearly luster irregular fracture and no cleavage. The tenacity is flexible. No fluorescence under UV radiation was observed. The Mohs hardness
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References cited


DAVIDSMITHITE*


G. Rossi, R. Oberti, and D.C. Smith (1989) The crystal structure of a K-poor Ca-rich silicate with the nepheline framework and crystal-chemical relationships in the compositional space (K₂Na₂Ca₄)(Al₈Si₁₆O₃₂). European Journal of Mineralogy, 1(1), 59–70.

Davidsmithite (IMA 2016-070), ideally (Ca,Si₈)₂Na₂Al₈Si₁₆O₃₂·2H₂O, hexagonal, is a newfeldspathoid mineral of the nepheline group that occurs it the retrograded jadeite-rich layers of Liset eclogite pond, Liset, Selje, Western Gneiss Region (WGR), Vestlandet, Norway (62°4′ N, 5°20′ E). The new mineral discovered in the thin section G201b7 originated from eclogite sample G201b7 of rock collection COSEM of the Museum National d’Histoire Naturelle (MNHN) in Paris, France. This thin section considered as holotype and is also a holotype for closely associated compositionally similar but structurally different mineral lisetite CaNa₂Al₄Si₈O₃₂. Other closely associated minerals are albite and taramite. Sometimes davidsmithite replacing a cluster of lisitite at its edges in an irregular corona style.

Relict jadeite and quartz, armored by coronas of clinohumite, occur nearby. Davidsmithite generally forms anhedral, and rarely skeletal or lath-like, crystals up to 80–100 µm long and about 30 µm wide in poikilocrystalline aggregates. The small size of the crystals, the frequent intergrown textures with lisitet, and or the presence of micro-inclusions prevented the measurement density and some other physical properties. Davidsmithite is colorless to pale yellowish in thin section. Twinning was not observed in thin section, although it is present in diffraction, probably polycrystalline on (100). Davidsmithite has white streak and vitreous to greasy luster. The Mohs hardness is 5½, D_{calc} = 2.59 g/cm³. The mineral is non-fluorescent. Optically it is uniaxial (-), ε = 1.538(2), ϵ = 1.535(2) (white light). The Raman spectrum shows the most intense band at 425 cm⁻¹ and a weaker shoulder at 475 cm⁻¹. No proofs of the presence of O–H stretching bands was obtained (in agreement with closure of EMP analyses). The average of 10 electron probe WDS analyses is [wt% (range)]: CaO 3.16 (3.10–3.22), K₂O 0.69 (0.56–0.81), Na₂O 16.89 (16.85–16.92), Al₂O₃ 35.52 (35.42–35.61), FeO 0.13 (0.07–0.19), SiO₂ 43.63 (43.06–44.21), MgO 0.02 (0–0.05), MnO 0.04 (0–0.07), NiO 0.01 (0–0.01), TiO₂ 0.04 (0–0.08), total 100.12. The empirical formula ([Ca₅.6₅O₃₂,Al₃.4₃O₇,F₄C₆.8₉O₄]₁ₒCaO₂₃Al₂O₃FeO₃F₃)₁₃O₁₄TeO₄-based on 32 O pfu. The strongest lines in the X-ray powder-diffraction pattern [d (Å, hkl)]: 4.322 (27.4, 020), 4.182 (65.7, 002), 3.840 (92.9, 021), 3.267 (71, 230), 3.006 (100, 022), 2.882 (41.3, 030), 2.575 (23.2, 232), 2.343 (53.6, 023), 2.305 (31.3, 341), 1.561 (27.4, 453,153,025). The single-crystal X-ray data obtained from the crystal of 0.3 x 0.2 x 0.1 mm shows davidsmithite is hexagonal, P6₃, a = 9.982(1), c = 8.364(1) Å, V = 721.7 Å³, Z = 1. The crystal structure of davidsmithite, refined to R₁ = 3.66% for 364 unique observed reflections with F² > 2σ(F²) and 10.41% for all 748 reflections, is the same tetrahedral framework as that of nepheline, but with the distribution of the Ca, Na, and K cations quite unusual: the large A cavity is statistically occupied by Ca⁺⁺ Na⁺⁺ K⁺⁻, with one position at the K position of ordinary nephelines but occupied by (Ca⁺⁺ Na⁺⁺) minor K⁺⁻, and a second position labelled Ca⁺⁺ and occupied by (Ca⁺⁺ Na⁺⁺⁻) displaced along the z axis at approximately 1.25 Å from the K position. The name honors David Christopher Smith (b. 1946), Emeritus Professor at the Muséum National d’Histoire Naturelle (MNHN) in Paris, France. As a mineralogist, he participated in discovery of the new minerals nyhítie, lisitite, taramite, and ferro-taramite in Norway. As a petrologist, he pioneered the recognition of the new sub-discipline of ultrahigh-pressure metamorphism (UHPM) well before coesite was found in Italy and in Norway. The above-mentioned holotype thin section G201b7 is now deposited in the Mineral Collection of MNHN under the number MNHN215-001. F.C.

EPIFANOVITE*


Epifanovite (IMA 2016-063), ideally NaCa₂Cu₃(PO₄)₉(asO₄(OH))₃·7H₂O, monoclinic, is a new phosphate–arsenate discovered in a quartz–apatite nest within georeenized cassiterite-rich granodiorite of the Kester tin deposit, Sakha-Yakutia, Russia. This nest is about 5 m in diameter and consists mostly of light gray botryoidal aggregates of fluorapatite (“staffellite”) up to 30 cm and porous milky quartz up to 10 cm. The fractures encrusted with dark green crystals or spherulites of As-rich pseudomalachite (up to 5 mm), light green lichtenhite crystals
NEW MINERAL NAMES


Ferro-tschermakite (IMA 2016-116), ideally \( ^{2+}[\text{Cu}^2_8\text{Mg}^2_6\text{Al}^3_2]^{2+}_1\text{Si}^{4+}_8\text{Al}^{3+}_4\text{O}_{22}^{6+}(\text{OH})_{2}\), monoclinic, is a newly characterized member of the calcium amphibole group (Hawthorne et al. 2012), coming from the dump of the Bâtiment et Granit de Ploumanač'h northern granite quarry, La Clarté, Perros-Guirec, Ploumanač'h granitic complex, Brittany, France (48°48′50″ N, −3°28′50″ W). The Perros-Guirec granite is a coarse-grained, porphyroid granite, where pronounced pink color due to the presence of large feldspar crystals, embedded in the Icartian basement (lower Brovierian 615 Ma), and intruded by veins of the pink Ploumanač'h granite. Ferro-tschermakite occurs as ~3 cm long aggregate of dark green bladed-to-acicular crystals associated with white plagioclase and in mioraitic texture in a granite pegmatite. Ferro-tschermakite is nonfluorescent and has a dark green streak and a vitreous luster. Cleavage, fracture, and hardness not reported. The density was not measured; \( \rho = 3.260 \text{ g/cm}^3 \). In transmitted plane-polarized light, ferro-tschermakite is pleochroic (\( X = \) pale yellow-green, \( Y = \) olive green, \( Z = \) blue-green). It is biaxial (−), \( \alpha = 1.666(2), \gamma = 1.680(2), \beta = 1.690(2) \) (\( \beta \) not reported), \( 2V(\text{meas}) = 84(1), 2V(\text{calc}) = 79.8^\circ \). The dispersion of an optical axis is medium (\( r > v \)), and the orientation is: \( X > a > 9.5^\circ \) (in β acute), \( b \parallel Z \parallel c = 24.3^\circ \) (in β obtuse). The average of 10 electron probe WDS analyses [wt% (range)] is: SiO\(_2\) 41.32 (40.61–42.55), TiO\(_2\) 0.35 (0.35–0.39), Al\(_2\)O\(_3\) 18.17 (17.72–18.41), Cr\(_2\)O\(_3\) 0.02 (0–0.03), V\(_2\)O\(_5\) 0.05 (0.01–0.08), Fe\(_2\)O\(_3\) 17.55 (17.18–17.82), FeO 15.66 and Fe\(_2\)O\(_3\) 2.09, MgO 6.94 (6.73–7.15), MnO 0.20 (0.15–0.22), NiO 0.01 (0–0.03), MnO 0.02 (0–0.04), CaO 10.58 (18.48–10.64), Na\(_2\)O 1.61 (1.30–1.74), K\(_2\)O 0.45 (0.42–0.46), H\(_2\)O [on the basis of 2 of (OH,F) pfu], F 0.12 (0–0.24), O=Fe 0.05, total 99.47. The empirical formula based on 24 (O,OH,F) pfu is \( \left( \text{Na}_{6.23}\text{K}_{0.06}\text{Li}_{0.33}\text{Ca}_{4.06}\text{Fe}^{2+}_{2.65}\text{Mn}^{2+}_{0.02}\text{Na}_{0.12}\text{H}_{0.20}\right)\left(\text{Fe}^{2+}_{1.94}\text{Mg}_{1.54}\text{Al}_{3.33}\text{Fe}^{3+}_{0.03}\text{V}^{3+}_{0.02}\text{Ti}^{4+}_{0.02}\text{Al}^{3+}_{2.00}\right)\text{O}_{32}^{2-}\left(\text{OH}^{−}_{0.48}\text{F}_{0.52}\right)\). The strongest lines in the X-ray powder diffraction patterns [\( d (\AA, \text{hk} \)]: 8.339 (100; 110), 2.708 (84; 151), 3.098 (55; 310), 2.552 (43; 302), 2.595 (41, 061), 2.330 (33; 351), 2.159 (27; 261), 2.936 (27; 221), 3.338 (27; 131), 2.012 (24; 302, 351). The single-crystal X-ray data obtained from a crystal of 0.14 × 0.13 × 0.05 mm shows that ferro-tschermakite is monoclinic, \( C2/m, a = 9.7958(6), b = 18.0220(11), c = 5.3293(5), \beta = 104.8246^\circ (1), V = 906.27(9) \text{Å}^3, Z = 2 \). The crystal structure refined to \( R_{B} = 2.5\% \) for 1249 unique observed reflections with \( F(2)>3(\sigma(F(2)) \) for 1377 unique reflections. Calculated <M(1)−O> and <M(3)−O> distances are significantly shorter than the measured values, which excludes the presence of trivalent cations at the M(1) and M(3) sites, and hence any depolymerization, so that the assumption of 24 (O,OH,F) atoms per formula unit (apfu) in the calculation of the formula unit is further supported. Ferro-tschermakite forms a series with tschermakite, \( ^{2+}[\text{Cu}^2_8\text{Mg}^2_6\text{Al}^3_2]^{2+}_1\text{Si}^{4+}_8\text{Al}^{3+}_4\text{O}_{22}^{6+}(\text{OH})_{2}\), the only composition related to the rootname “tschermakite” so far recognized as a valid mineral species by IMA-CNMNC (Winchell 1945; Abdu and Hawthorne 2009). However, according to the classification rules in force, that amphibole now falls in the compositional field of magnesiohornblende (although with a significant paragistic component) and must be considered as named amphibole (Burke and Leake 2004) and a potential new mineral. The holotype ferro-tschermakite is deposited in the mineralogical collections of the Museo di Mineralogia of the Università di Pavia, Italy, F.C.

References cited

**GREENLIZARDITE**


Greenlizardite (IMA 2017-001), (NH₄)₂Na(UO₂)₂(SO₄)₂(OH)₂⋅4H₂O, triclinic, is a new mineral discovered at the Green Lizard mine, Red Canyon, White canyon district, San Juan County, Utah, U.S.A. (37°34′37.10″N, 110°17′52.80″W) and named for its type locality. It is a secondary alteration assemblage from hydrocerussite, abellaite, and plumbonacrite. The characteristic X-ray diffraction patterns are similar to that of nearby located Blue Lizard, Giveaway-Simplot, sahlinite, rhodochrosite, and baryte. Textural and paragenetic observations suggest that the mineral may have formed as a consequence of regional metamorphism. Greenlizardite forms platy grains up to 1 mm across and up to 0.2 mm thick included in, and intergrown with, massive cerussite. In one portion of the studied material it occurs as platy aggregates up to several millimeters. Grootfonteinite is colorless, with white streak and adamantine luster. It is brittle with a perfect cleavage on [010] and no parting. The fracture is uneven across the cleavage planes. The microindentation hardness VHₙₚₜ = 35.3 (48.7–66.1) kg/mm², corresponding to a Mohs hardness of ~2. The lack of material and high density prevented its measurement; Dcal = 6.856 g/cm³. In reflected light, greenlizardite is gray. It is non-pleochroic, with abundant white internal reflections and a very weak bireflectance masked by the internal reflections. The reflectance measurements made in air in the range 400–700 nm with 20 nm interval. The values [Rmin/Rmax (%)(nm)] for COM wavelengths are 13.0/10.8 (470), 12.6/10.5 (546), 12.5/10.3 (589), 12.3/10.2 (650). The IR spectrum is rather similar to that of the related minerals hydrocerussite and plumboascite, and shows (cm⁻¹): s = strong band, w = weak band, sh = shoulder): 3470w, 3386w (O–H stretching vibrations); 1738 (overtone of in-plane bending vibrations of CO₃²⁻; 1418 s, 1380 sh (asymmetric C–O stretching vibrations of CO₃²⁻); 1200 (combination mode involving Pb–O stretching and O–C–O bending vibrations); 1046 (symmetric C–O stretching vibrations of CO₃²⁻); 837 (out-of-plane bending vibrations of CO₃²⁻); 685s, 680s (in-plane bending vibrations of CO₃²⁻); 480 (Pb–O stretching vibrations). The average of 10 electron probe WDS analyses is [wt% (range)]; Na 0.92 (0.88–0.95), Ca 0.26 (0.23–0.29), Pb 79.66 (79.40–80.09), O 16.28 (15.70–17.02), C (by stoichiometry) 3.49, H (by charge balance) 0.05, total 100.66. The empirical formula is H₈Nd₂Na₂Ca₂(PO₄)₂(CO₃)₂⋅(OH)₄ based on 7 O and 2 C apfu. The strongest lines in the X-ray powder-diffraction pattern [d Å (Pb/C); %] are: 4.586 (25; 010), 3.244 (100; 013), 2.652 (30; 110), 2.294 (21; 020), 2.053 (39; 023). The lattice parameters refined with powder data in the hexagonal unit-cell, are: a = 5.300(2), c = 13.761(2) Å, V = 332.88 Å³, Z = 2. The single-crystal X-ray data obtained from the crystal of 0.12 × 0.12 × 0.005 mm shows greenlizardite is hexagonal, P6₃/mmc, a = 5.303(1), c = 13.770(3) Å, V = 335.3 Å³, Z = 2. The crystal structure of greenlizardite was refined to R₁ = 5.16 % for 178 unique observed F2 and all 185 reflections. Greenlizardite is structurally related to hydrocerussite, abellaite, and plumboascite. The characteristic structural feature of all these minerals is the presence of [P6CO₃]²⁻ sheets.
perpendicular to the ε axis (C-type sheets), in the upper and lower parts of invariably electronune 2D blocks, the middle part being variable. The topology of these intermediate 2D blocks in the structure of groothoovite can be considered as intermediate between those of abellite and hydrocorussite. In the structure of groothoovite Pb1- and Pb2-centered polyhedra share common O atoms to form two-dimensional blocks. Additionally, sheets of composition \([\text{Pb}_n\text{O}_m\text{Na}_p\text{O}_q\text{O}^\circ\text{OH}^\circ]_r\) formed by the Pb2 and O2 sites (LO sheets) are sandwiched between every other pair of C-type sheets. Groothoovite is named after the locality in the Groothoovite district. The type material is deposited in the collections of the Swedish Museum of Natural History (Stockholm, Sweden). E.C.

**JANCHEVITE**

N.V. Chukanov, D.O. Nekrasova, O.I. Siidra, Y.S. Polekhovsky, and J.V. Pekov (2018) Janchevite, \(\text{Pb}_5\text{V}^5\text{(O}_4\text{,C}^0\text{,Cl})_3\), a new mineral from the Kombat Mine, Namibia. Canadian Mineralogist, 56(2), 159–165.

Janchevite (IMA 2017-079), ideally \(\text{Pb}_5\text{V}^5\text{(O}_4\text{,C}^0\text{,Cl})_3\), tetragonal, is a new mineral species from the abandoned Kombat copper mine located in the Groothoovite district, Otojonzudupa region, northern Namibia. Janchevite is the 14th new mineral discovered in the Kombat mine. It formed as a consequence of regional metamorphism of a primary, Pb–Mn–(As–Ba)-rich, chemically heterogeneous, volcanic hydrothermal assemblage. Associated minerals are baryte, hausmannite, calcite, magnesite, and kambite. Janchevite occurs as thick tabular anhedral to subhedral grains up to 0.4 × 0.8 × 0.8 mm in size and it is translucent, orange-red with orange streak; the luster isadamantine. The mineral is brittle with distinct cleavage on {001}. The induration hardness \(\text{VHN}_{\text{max}} = 85.8\) (73.4–100.8) kg/mm\(^2\) corresponding to \(2/3\) of a Mohs scale. The density was not measured; \(\text{D}_{\text{mol}} = 8.160\) g/cm\(^3\). The color in reflected light is light gray, with deep red internal reflections. Janchevite is weakly anisotropic. The reflectance spectrum was measured between 400 and 700 cm\(^{-1}\). The unit-cell parameters refined from powder-diffraction data are: \(a = 3.955(2), c = 22.626(7)\ Å, V = 355.9\ Å\(^3\), space group \(I4/mmm, Z = 1\). In spite of the low quality of crystals due to their mosaicity, the single-crystal X-ray data confirmed the unit cell \(a = 3.959(5), c = 22.6897(3)\ Å, V = 355.65\ Å\(^3\)\) and allow one to consider that janchevite has the crystal structure of parkinsonite and asisite. Janchevite belongs to the family of Pb–O blocks alternating with tetragonal sheets of \(\text{Pb}–\text{O}\) blocks. In parkinsonite and asisite the stacking sequence of the sheets is \(\ldots\text{ClPb}–\text{OPb}–\text{OPb}–\ldots\) and \(\ldots\text{Pb}–\text{O}–\text{Pb}–\ldots\), respectively, i.e., the \((\text{Pb}–\text{O})_4\) ratio is \(2:1\). Janchevite is a vanadium-dominant structural analog of parkinsonite \(\text{Pb}_5\text{O}_7\text{Cl}_3\). Janchevite is chemically related to kambatite \(\text{Pb}_5\text{O}_7\text{Cl}_3\), although the crystal structure and powder X-ray diffraction pattern of kambatite are quite different from those of janchevite. Janchevite is named in honor of the prominent Macedonian mineralogist Simeon Janchev, a specialist in the mineralogy and petrology of igneous rocks and metasomatic ore deposits. The holotype specimen of janchevite is deposited in the collections of the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. E.C.

**JAVORIEITE**


Javorieite (IMA 2016-020), \(\text{KFeCl}_3\), orthorhombic, is a new mineral, discovered in salt melt inclusions enclosed in vein quartz in the Biely Vrch porphyry gold deposit (3.5 km southeast of the town Dětva) located in the central zone of the Javorie andesitic stratovolcano, which is part of the Middle Miocene Central Slovakia Volcanic Field in the Western Carpathians. Porphyry gold mineralization hosted by stocks of diorite porphyries emplaced in andesites and prevolcanic basement rocks. The vapor inclusions are dominant at Biely Vrch in all generations of vein quartz. The coeval salt melt inclusions mostly hosted by granular vein quartz but rarely found in pyroxene veinlets. Javorieite was also found in three other localities in this volcanic field. Javorieite occurs as the major solid phase in every salt melt inclusion. Other associated minerals within most of inclusions are halite, chlorocalcite, rinnite, and the phase close to \(\text{Fe}_2\text{O}_3\text{Cl}\) (probably hibbingite). Some inclusions contain fluorite, scheelite/powellite, unidentified Ba-, Zn-, Pb-bearing chlorides with a very rare presence of some salt hydrates (e.g. \(\text{FeCl}_2\) \(\cdot\) \(2\) \(\text{H}_2\text{O}\)), magnetite, K-feldspar, pyroxene, scheelite, and chlorocryptite. Javorieite forms green anhedral crystals up to 15 μm differ by high relief compare to other phases and melting in the range 320–338 °C when heated. The experimental data in the NaCl–KCl–FeCl\(_3\) system agree with the microthermometric behavior of javorieite. This phase has never been described as a mineral due to an extremely strong liability to hydration and oxidation when the host inclusions are opened to air. Due to that nature most of physical properties were not obtained. The Raman spectra acquired in the 65–4000 cm\(^{-1}\) interval show the main bands at 66–69, 108–109, 119–120, 134–135, and 235–237 cm\(^{-1}\) and are (after quartz subtraction) nearly identical to those of synthetic KFeCl\(_3\) with minor differences probably related to admixtures in the natural sample. Further identification of the mineral done using the FIB-SEM-EBSD analytical technique. The standardless electron probe EDS analyses of the grains exposed to the surface, obtained at the same spots where the EBSD pattern and Raman spectra were, successfully matched to those of synthetic KFeCl\(_3\). Since the size of inclusions was smaller than the excitation volume, all analyses were affected by the neighboring solid phases and the host quartz. The ranges for 8 analyses of three samples from the various depths of the Biely Vrch deposit are (wt% normalized to 100%): Si 1.0–1.84, Al 0–0.4, O 1.7–16.9, Fe 15.6–21.5, Mn 1.3–4.2, Ca 0–0.6, Na 0.5–2.3, K 11.5–18.5, Cl 35.5–53.5. Variations of the number of atoms per formula unit in empirical formula based on 5 apfu (after subtracting Si, Al, and O) are: K 0.84–1.06, Na 0.05–0.28, Ca 0.0–0.04, Fe 0.72–1.03, Mn 0.06–0.16, Cl 2.78–3.14. X-ray powder and single-crystal studies of javorieite were not performed due to the small crystal size. The strongest lines in the X-ray powder-diffraction pattern obtained for synthetic KFeCl\(_3\), \([d \text{ Å} (\%\{hkl\})]\) are: 7.07 (36; 002), 2.88 (31; 210), 2.83 (25; 008), 2.794 (100; 110), 1.992 (26; 118), 1.988 (49; 020), 1.649 (46; 215). The unit-cell parameters refined from powder-diffraction data are: \(a = 3.955(2), c = 22.626(7)\ Å, V = 355.9\ Å\(^3\), space group \(I4/mmm, Z = 1\). In spite of the low quality of crystals due to their mosaicity, the single-crystal X-ray data confirmed the unit cell \(a = 3.959(5), c = 22.6897(3)\ Å, V = 355.65\ Å\(^3\)\) and allow one to consider that javorieite has the crystal structure of parkinsonite and asisite.
most porphyry gold systems in this volcanic field. No data on location of any kind type material provided. D.B.

**KAMPelite**


Kampilite (IMA 2016-086), ideally Ba$_2$Mg$_3$Sc$_2$(PO$_4$)$_3$(OH)$_2$, orthorhombic, is a new Ba–Sc phosphate from the Kovdor phoscorite–carbonatite complex (Kola Peninsula, Russia, N67°33′′, E30°31′′). The crystal of 0.11 × 0.08 × 0.001 mm shows kampelite is orthorhombic, $a = 11.2261(9), b = 8.5039(6), c = 27.6992(2)$ Å, $V = 2644.3$ Å$^3$, $Z = 4$. The crystal structure of kampelite, refined to $R = 9.2\%$ for 2620 unique observed reflections with $F > 4\sigma(F)$, is based upon complex [Mg$_5$Ba$_2$Sc$_2$(PO$_4$)$_3$]$^+$ layers consisting of the Ba–PO$_4$ zigzag sheet inserted between two Mg–Sc–PO$_4$ sheets. Kampelite is named in honor of Russian petrologist Felix Borisovich Kampel (b. 1935) for his contributions to the development of technologies of mining and processing of the complex. The holotype specimen is deposited in the Mineralogical Museum of St. Petersburg State University, Russia. F.C.

**ROYMILLERITE**


Roymillerite (IMA 2015-093), ideally Pb$_2$Mg$_3$(Si$_2$Al$_2$O$_7$)(SiO$_2$)(BO$_3$)(CO$_3$)$_3$OH$_2$O, triclinic, is a new mineral species from the Kombat Mine, Otavi Valley, 49 km south of Tsumeb, Grootfontein district, Otjozondjupa region, northern Namibia. Roymillerite occurs in a predominantly fine-grained groundmass of rhodochrosite, cerussite, and other associated minerals mainly within a rhodochrosite band, while grootfonteinite occurs in a groundmass dominated by cerussite, with disseminated crystals and subhedral grains of Mn–Fe oxides, and locally euhedral to subhedral melanotekite. Granular aggregate of salinliste platelets constitutes a separate band. Roymillerite forms platy single-crystal grains and aggregates up to 1.5 mm across and 0.3 mm thick. The only distinct form is [001]. Crystals are transparent, colorless, with a white streak. The luster is strong, vitreous. Cleavage is perfect on [001]; thin platelets are flexible, non-elastic. Fracture is uneven. Parting has not been observed. The Mohs hardness is ~3. The density was not measured because of the absence of heavy liquids with $D > 5$ g/cm$^3$. $D_{\text{meas}} = 5.973$ g/cm$^3$. The mineral is nonfluorescent under both long- and short-wave UV radiation. In transmitted light roymillerite is non-pleochroic, colorless. It is optically biaxial (+), $\alpha = 1.86(1)$, $\beta = 1.94(1)$ (589 nm). $2V_{\text{meas}} = 5\degree(5)$; $X \times c$. Dispersion of optical axes was not observed. The IR spectrum is similar to that of the related mineral britvnite. Absorption bands are cm$^{-1}$: s = strong band, $\omega$ = weak band, sh = shoulder: 3700, 3583, 3513, 3352 (O–H stretching vibrations of OH groups), 2396w (possibly, acid Si–OH group), 1726w (combination mode), 1385s (asymmetric stretching vibrations of CO$_3^-$ groups), 1213, 1204 (symmetric stretching vibrations of BO$_3^-$ groups), 1083, 1050s, 1042, 999s (Si–O stretching vibrations of the SiO$_4$ tetrahedron, 915, 898, 875s (Si–O–Si stretching vibrations of isolated SiO$_4$ groups), 842w, 806w, 780w (out-of-plane vibrations of CO$_3^-$ groups, possibly combined with Mg–OH and Pb–O–H bending vibrations), 725w, 688, 679 (in-plane vibrations of CO$_3^-$ groups, possibly combined with O–Si–O bending vibrations of the SiO$_4$ tetrahedron), 635w, 605w, 580w, 548w, 467s, 420s, 400s (combination of Si–O–Si bending and Mg–O–Si stretching vibrations). The average of 7 electron probe WDS analyses is $\%$ (wt%): SiO$_2$ 70.90 (70.6–70.8), MgO 4.93 (4.87–5.2), MnO 1.24 (1.1–1.2), FeO 0.93 (0.81–0.96), PbO 75.38 (74.16–76.82). B$_2$O$_3$ 0.50 (from structural data), Al$_2$O$_3$ 0.74 (0.64–0.88), CaO 5.83 ± 0.15 and H$_2$O 1.8 ± 0.2 (both by gas chromatography), total 99.27. The empirical formula [Pb$_2$Mg$_3$(Si$_2$Al$_2$O$_7$)(SiO$_2$)(BO$_3$)(CO$_3$)$_3$OH$_2$O] based on 83 O p.f.u. The strongest lines in the X-ray powder-diffraction pattern [d (Pd, hkl) Å] are: 15.80 (100; 001), 13.86 (45; 002), 3.184 (18; 222), 3.129 (19; 026), 2.756 (16; 402), 2.688 (24; 10.10). The unit-cell parameters refined from powder-diffraction data are: $a = 11.2561(1), b = 8.5121(1), c = 27.7074(4)$ Å, $V = 2654.6$ Å$^3$. The single crystal X-ray data obtained from the crystal of 0.11 × 0.08 × 0.001 mm shows kampelite is orthorhombic,


Vanadio-pargasite (IMA 2017-019), ideally NaCa$_2$Mg$_5$[Si$_4$Al$_2$]O$_{12}$(OH)$_2$, monoclinic is a new species of an amphibole group discovered at the Pereval marble quarry in Cr–V-bearing marbles, near the town of Studyanka, Lake Baikal, Russia. The dolomite-calcite marbles contain bands or thin (0.5–3 cm) layers consisted mostly of black magnesio-cosonite–magnesochromite. The brightest green vanadio-pargasite with highest V$_2$O$_5$ content occurs at the contacts of layers with marble. The V-rich amphibole of less intensive color forms crystals and aggregates up to 2 mm in marble along with bright-red Cr–V-rich spinel. Other associated minerals are plagiophile, forsterite, Cr–V-bearing diopside and chlorite. Vanadio-pargasite forms bright-green to emerald-green vitreous subhedral long- and short-prismatic crystals from 0.05 x 10.0 to 0.10 x 0.8 mm. The habit forms are {010} and {110} with a typical amphibole striation. The streak is pale green. The cleavage is perfect on {110}; fracture is uneven. The indentation hardness VHN$_{10}$ = 226 (218–240) kg/mm$^2$, which corresponds to a Mohs hardness of 3–3 ½. The density was not measured; $\Delta_{DI}$ = 6.650 g/cm$^3$. In reflected plane-polarized light tredouxite is light gray non-pleochroic with a weak yellow streak. It is brittle with no cleavage. The micro-indentation hardness VHN$_{12}$ = 197.91(3) kg/mm$^2$ corresponding to ~6 of Mohs scale. The mineral is slightly magnetic. D = 3.05(5) (Clerici solution). $\Delta_{DI}$ = 3.112 g/cm$^3$. Under plane-polarized transmitted light, the mineral is pale green, non-pleochroic. Vanadio-pargasite is optically biaxial (+), $\alpha$ = 1.643(2), $\beta$ = 1.651(2), $\gamma$ = 1.659(2) (white light) (dispersion was not mentioned), 2V$^\prime$ = 86°(2), 2V$^\prime$$_{calc}$ = 89.6° optical sign is unclear since 2V$^\prime$ is very close to 90°, Z$_{calc}$ = 23–25°. The main bands of IR spectrum (cm$^{-1}$) are: 3435 (O = H stretching), 1633 (H$_2$O bending), wide band with maxima 1050, 980, 919 (Si = OSi stretching), 469 (Mo = O) and SiO$_2$–bending vibrations in SiO$_2$, tetrahedra. The thermogravimetry and differential scanning calorimetry studies were performed between 42 and 1400 °C and combined with a gas composition control. Main water release at 654–1081 °C matched by endothermic effect. The main endothermic effect at 900–1173 °C related to structural changes, water (and probably F$^-$ release) and melting the mineral at 1020 °C. The average of 528 electron probe WDS analysis on 166 grains is [wt% (range)]: SiO$_2$, 42.75 (41.3–44.32), [Ni$\text{Sb}_2$(OH)$_2$.6H$_2$O]. A small (0.050 x 0.065 x 0.085) fragment with minor intergrowth was studied by single-crystal X-ray diffraction yielding the following unit-cell parameters: $a$ = 4.6342(5), $c$ = 9.2064(4) Å, $V$ = 198.01 Å$^3$. Most single crystals of tredouxite tested were an intergrowth of two phases: tredouxite and weakly diffractive bottniuite [Ni$\text{Sb}_2$(OH)$_2$.6H$_2$O].

Wilancookite (IMA 2015-034), ideally (Ba,K,Na)(Ba,LI,Be)P₂O₆(OH)₂, 3H₂O, is a new mineral species from the Lavra Ponte do Piauí complex granitic pegmatite, Itinga, Jequitinhonha, Minas Gerais, Brazil (16°43′33″ S, 41°53′55″ W). Wilancookite is a secondary mineral occurring in phosphate nodules adjacent to the quartz core of the pegmatite. Primary associated minerals are albite, montebrasite, Li-bearing micas, natromicrolite, (Na,Ca,U)Ta₂O₆(OH), and in the Natural History Museum of Luxembourg (cotype used for chemical analyses: catalogue number 20394).

Six new pyrochlore-supergroup minerals were recently described. The general formula of the pyrochlore supergroup is A₂B₂X₆O₁₅(F,OH)²⁻. Six new pyrochlore-supergroup minerals were recently described.
commonly V\(^{3+}\), Sn\(^{4+}\), Zr, Hf, Fe\(^{3+}\), Mg, Al, and Si. The X site 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\(_2\)O, 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, Sn\(^{4+}\), or W in the B site defines the group name within the supergroup (microlite, pyrochlore, betafla, römeite, or elmoreite, 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\(_2\)O or O] at the Y site. The second prefix refers to the dominant cation of the dominant valence [or H\(_2\)O or O] at the A site. All names of new pyrochlore-supergroup mineral species below are given according those rules. That nomenclature scheme bases names upon the preponderant species of preponderant valence group in each site of the structure. However, the variety of possible coupled substitutions is such that a valid species name can be associated with either one, several, or no end-members. Most of currently known pyrochlore-supergroup mineral species below are given according those rules. The most common of these is \(3R\) with the space group \(R3\). Descent in symmetry splits the \(A, B\), and \(X\) sites in the structure.

**Fluorocalciopyrochlore** (IMA 2013-055), (Ca\(_{1.70}\)Na\(_{0.30}\)Nb\(_2\)O\(_6\)F\(_2\), cubic, was found in the dolomitic carbonatites of the Bayan Obo (the world\’s largest REE and major iron and niobium deposit), Inner Mongolia, People\’s Republic of China (41\(^\circ\)47\'8.7"N, 109\(^\circ\)58.17"E). An F-rich pyrochlore was first mentioned by Hogarth (1961). The pyrochlores of composition similar to fluorocalciopyrochlore were mentioned in the different and associations but mostly in carbonatites (Ohnenstett and Plantone 1992; Nasraoui and Bilal 2000; Seifert et al. 2000; Thompson et al. 2002; Bonazzi et al. 2006; Jung et al. 2006), however those minerals were not sufficiently characterized to grant them official status of a distinct species. Fluorocalciopyrochlore was listed as a possible new species by Christy and Atencio (2013). Fluorocalciopyrochlore from Bayan Obo disseminated as fine euhedral or subhedral grains or veinlets scattered in dolomite and calcite. All these minerals seemed to be crystallized at the same time. The mineral was perhaps a product of bimetasomatism among Ca–Mg-carbonate rock and carbonatite and REE-, F-rich postmagmatic hydrothermal solutions. Other associated minerals are aegirine, riebeckite, diopside, fluorite, baryte, phlogopite, britholite-(Ce), bastnäsite-(Ce), zircon, magnetite, hydroxycalciomicrolite, riebeckite, diopside, fluorite, fluorapatite, gahnite, goethite, hematite, ixiolite, “lepidolite,” magnetite, microcline, monazite-(Ce), muscovite, quartz, rutile, samarskite-(Y), spodumene, tantalite-(Mn), “tormaline,” “varlomafite,” xenotime-(Y), and zircon along with other microcline-group minerals hydrokenomicrolite and fluorocalciomicrolite. The present specimen is from the Museu de Geociências, Universidade de São Paulo where it was labelled as “djalmaite” (donor unknown). Fluorocalciomicrolite forms translucent yellow isolated octahedral crystals up to 1.5 mm often modified by \([110]\). The mineral has white streak and vitreous to resinous lustre. It is brittle with conchoidal fracture and no cleavage. Mohs hardness is 5–6. Density was not measured, \(D_{\text{os}} = 6.176 \text{g/cm}^3\). Fluorocalciomicrolite does not fluoresce under UV radiation, nor under electron beam. It is colorless under plane-polarized light; isotropic; \(n_{\text{os}} = 2.010\). The main absorption bands of the IR spectrum (cm\(^{-1}\), \(w\) = weak) are: 3580, 3599w (O–H stretching vibrations), 856, 900, 1010, 1075w (overtones and combination modes). Absence of peaks at 1500–1700 cm\(^{-1}\) suggests all hydrogen is present as OH groups. The Raman spectrum shows bands at 3586 and 3614 cm\(^{-1}\) (O–H stretching vibrations). The average of 13 electron probe WDS analyses is [wt% (St.dev.): Na\(_2\text{O}\) 0.36(8), CaO 15.64(13), SnO\(_2\) 0.26(3), Nb\(_2\text{O}_5\) 2.82(30), TaO\(_2\) 78.39(22), MnO 0.12(2), Fe\(_2\text{O}_3\) 0.10(3) by structural data], \(O=F\); 0.30, total 99.31. This gives the empirical formula \(\text{Ca}_3\text{Na}_2\text{Sn}_6\text{Mn}_1\text{O}_{32}\) instead of \(\text{Ca}_3\text{Na}_2\text{Sn}_6\text{Mn}_1\text{O}_{32}\) \(\text{Ta}_2\text{O}_5\text{Sn}_{10}\text{Sn}_{10}(\text{OH})_3\text{Fe}_3\text{O}_{32}\text{O}_{16}\) based on 2 cations pfu at B site. The strongest lines in the X-ray powder-diffraction pattern \([d (\text{Å}; hkl)]\) are: 6.025 (100; 111), 3.010 (73; 222), 3.145 (15; 311), 1.843 (5; 440). The unit-cell parameters refined from powder-diffraction data are: \(a = 10.4280(8) \text{ Å}, \ V = 1134.04 \text{ Å}^3\). Single-crystal X-ray diffraction data collected on a crystal of size \(50 \times 40 \times 20 \text{ mm}\) refined to \(R = 0.03\) for 497 unique \(2\theta(I)\) reflections shows the space group \(P4_32_12, a = 10.4205(1) \text{ Å}, \ V = 1131.53 \text{ Å}^3, Z = 8\). Hydroxycalciomicrolite is the first pyrochlore-supergroup mineral exhibiting \(P4_32_12\), instead of \(F\bar{3}m\). The presence of weak reflections violating the \(P\)-lattice was confirmed by both X-ray and neutron diffraction. It caused by long-range ordering of Ca and vacancies on the \(A\) sites. Type material is deposited in the Museu de Geociências, Instituto de Geociências, Universidade de São Paulo, São Paulo, Brazil. Part of the cotype sample has been deposited at the University of Arizona Mineral Museum, RUIFF Project.

**Hydroxyferroroméite** (IMA 2016-006), (Fe\(_2\text{O}_3\), Sn\(_2\)O\(_3\), Fe\(_2\)O\(_3\), OH), cubic, is a new Fe\(^{3+}\)-dominant member of the römeite group, and first species of the pyrochlore supergroup with Fe\(^{3+}\) dominant in the \(A\) site, was found at the Corrêa de l\'Enlinassos, Oms, Pyrénées-Orientales Department, France \((42^\circ32'16''N, 2^\circ42'26''E)\) in the only two specimens. It is associated with hematite, goethite, chalcopyrite, tetrahedrite, and native antimony and occurs as yellow to yellow-brown powdery boxwork replacements up to about 50 μm across after tetrahedrite in a siderite–quartz matrix in siderite-rich carbonatites. The mineral formed from the decomposition of tetrahedrite under mildly acidic and oxidizing conditions. According to Ian Graham (personal communication) hydroxyferroroméite was also found in Australian Museum specimen D53310 and Museum Victoria specimen M50201 originated from the Consols Mine Broken Hill, New South Wales, Australia, where it associated with chlorargyrite and dysarsite. Hydroxyferroroméite It has a yellow streak and an earthy to vitreous luster. The Mohs hardness is \(~3\), but that of single crystals could be higher. A conchoidal fracture.
could be seen on the boxwork veins. No other physical and optical properties were determined due to the very fine-grained and porous nature of the material. The main absorption bands of Raman spectrum (cm\(^{-1}\)) are: 3634, 3074, 2936 (OH stretching), 1773, 1706, 1680 (H-O-H bending modes), 650 with a shoulder at 709 and a weak band at 568 (Sr-O bridging), 466, 436, 358 (Sr-O vibrations), 271, 180 (lattice modes). X-ray photoelectron spectroscopy showed the presence of only Fe\(^{2+}\), Cu\(^{2+}\) and Sb\(^{5+}\) in the sample, with no Fe\(^{3+}\), Cu, or Sb. The average of 9 electron probe WDS analyses is [wt\% (range)]: Sb\(_2\)O\(_5\) 67.10 (64.72–70.43), As\(_2\)O\(_3\) 0.15 (0.07–0.28), SiO\(_2\) 1.17 (0.65–2.02), Al\(_2\)O\(_3\) 0.28 (0–1.94), CaO 0.18 (0–1.40), SrO 0.58 (0.47–0.77), FeO 16.95 (15.60–17.66), CuO 8.69 (7.53–9.34), ZnO 0.54 (0.40–0.72), H\(_2\)O (calculated on the basis of 7 O+OH+H\(_2\)O) 1.72 (1.16–2.27), total 97.36. This gives the empirical formula (Fe\(^{2+}\)\(_{1.21}\)Cu\(^{2+}\)\(_{0.5}\)Ca\(_{0.02}\)Sr\(_{0.03}\)Ba\(_{0.02}\)Zn\(_{0.02}\)Si\(_{0.01}\)Al\(_{0.01}\)O\(_{10.02}\)(OH)\(_{0.98}\)O\(_{1.02}\) based on 7 (O+OH) pfu. The strongest lines in the X-ray powder-diffraction pattern [d Å (P\(_h\) hkl)] are: 2.983 (100; 202), 3.128 (64; 113), 1.8249 (57; 208;202), 3.59 (51; 101), 1.5579 (47; 226), and 2.582 (32; 024). The unit-cell parameters refined from the X-ray powder-diffraction data are: \(a = 7.313(2)\) Å, \(V = 827\) Å\(^3\). Single-crystal X-ray diffraction data collected at 100 K refined to \(R = 0.1388\) for 198 unique \(\Sigma 6\) reflections shows hydroxynemoelsmoreite is trigonal, space group \(R\overline{3}\), \(a = 7.2855(10)\), \(c = 17.8584(4)\) Å, \(V = 829.9\) Å\(^3\), \(Z = 6\). The refined structure corresponds to a charge-balanced formula (Cu\(_{0.12}\)Pb\(_{0.98}\)W\(_{1.16}\)Fe\(_{0.84}\)Al\(_{0.08}\)O\(_{10.16}\)(OH)\(_{0.60}\)O\(_{6}\). The significant difference from EMPA data is explained by variable compositions in zoned crystals. Increasing Pb\(^{2+}\) in the A sites demonstrates solid solution towards a hypothetical “plumboloempoelmosite” species. Among a number of different non-cubic pyrochlore polytypes the most common is 3P polytype with the space group \(R\overline{3}m\). Descent in symmetry splits the A, B, and X sites making structural formula (\(A_1\),\(A_2\),\(B_1\),\(B_2\),\(X_1\),\(X_2\),\(Y\)). For the hydroxykenoelsmoreite-3R, unlike hydroxymonoclinelite-3R (Atencio, 2016), the symmetry is further lowered to \(R\overline{3}m\), due to very small rotations of coordination polyhedra that are not associated with further site splitting. The deviation from the cubic symmetry of hydroxynemoelsmoreite-3R is mostly due to the ordering of Fe\(^{2+}\) onto one of two B sites. Type specimen is type specimen was deposited in the Museum Victoria, Melbourne, Victoria, Australia.

**Hydroxynatropyrochlore** (IMA 2017-074), (Na\(_{2}\)Ca\(_{2}\)Ce\(_{3}\)Nb\(_2\)O\(_{13}\)), cubic, was described from Kovdor massif, Kola Peninsula, Russia. The pyrochlore-supergroup minerals are abundant in the Kovdor phosphorite-carbonatite pipe with the economic-level concentration in its axial zone. About one quarter of pyrochlore-supergroup minerals in Kovdor is the hydroxynatropyrochlore, and the rest includes mainly hydroxy-calciopyrochlore and a U–Th–REE-rich variety of a recently approved hydroxykenoelsmoreite (see above), which was known at Kovdor previously as “hatchettolite.” Hydroxynatropyrochlore was noted before in Khibiny, Sebl'yar, and other alkaline and alkaline–ultrabasic massifs (Yakovenchuk et al. 2005; Subbotin and Subbotina 2000), but it has not been fully characterized. Within the Kovdor phosphorite-carbonatite pipe, hydroxynatropyrochlore is the late hydrothermal mineral resulted mainly from the alteration of Nb-rich baddeleyite. It forms external rims around grains of amorphous U-rich hydroxykenoepyrochlore and separated crystals in voids of dolomite carbonatite veins. The crystals are usually cubic or cube-octahedral up to 0.7 mm, zonal, with irregularly shaped relics of U–Ta-rich hydroxykenoepyrochlore inside. Other associated minerals are calcite, forsterite, hydroxylapatite, magnetite, and plagioplite, accessory baddeleyite, baryte, barytocalcite, chalcopyrite, chromite–clinohlore, galena, gladusite, juonnite, ilmenite, magnetite, pyrite, pyrrhotite, quintinite, spinel, strontianite, valleriite, and zirconolite. Hydroxynatropyrochlore is pale-brown, with an adamantine to greasy luster and a white streak. It is brittle with distinct cleavage on {111} and conchoidal fracture. Mobs hardness is ~5–6. D\(_{\text{max}}\) = 4.60(5); D\(_{\text{calc}}\) = 4.77 g/cm\(^3\) (difference assigned to admixture of hydroxykenoepyrochlore). No fluorescence in UV was observed. In transmitted light, the mineral is light brown, isotropic, n = 2.10(5) (\(\lambda = 589\) nm). The mineral slowly dissolves in hot HCl and this process is activated by its metamictization due to the high contents of U and Th. The Raman spectrum of Hydroxynatropyrochlore shows the bands at (cm\(^{-1}\), sh = shoulder) at 3540, 3460, 3250 (O–H stretching), 810, 624, 545 and 453 (stretching vibrations in BO\(_2\) octahedra), 265 (bending vibrations in BO\(_2\) octahedra), 170, 128sh, 94, 75sh (lattice modes) with no characteristic bands of the H\(_2\)O vibrations. The average of unspecified number of electron microprobe WDS analysis [wt% (standard deviation)] is: Na\(_2\)O 7.97 (0.09), CaO 10.38 (0.47), TiO\(_2\) 4.71 (1.24), FeO 0.42 (0.59), NbO\(_2\) 56.44 (0.40), CeO\(_2\) 3.56 (0.77), TaO\(_2\) 4.73 (3.90), ThO\(_2\) 5.73 (1.51), UO\(_2\) 3.66 (0.25), F 0.05 (0.06), –O=F, 0.02, total 97.63. The water content was not determined due to the intimate association with U–Th–REE-rich hydroxykenoepyrochlore and estimated as 2.37 wt% by difference considering IR data. The empirical formula based on Nb\(_2\)Ta\(_2\)Ti = 2 apfu is: (Na\(_{1.02}\)Ca\(_{0.94}\)Ce\(_{0.03}\)Th\(_{0.01}\)U\(_{0.01}\)Fe\(_{0.02}\)W\(_{0.02}\)Nb\(_{0.02}\)Ta\(_{0.02}\)Ti\(_{0.02}\)O\(_{13}\)(OH)\(_{0.60}\)F\(_{0.02}\). The strongest X-ray powder...
diffraction lines \([d \text{ Å} (hkl)]\) are: 5.96 (47; 111), 3.15 (110; 30; 311), 2.580 (100; 222), 2.368 (19; 400), 1.9875 (6; 333), 1.8257 (25; 440), 1.5561 (14; 622). The unit-cell parameters refined from the powder data are \(a = 10.3211(3) \text{ Å, } V = 1099.46 \text{ Å}^3\). The crystal structure of hydroxysynthinyrolchlore refined to \(R_\text{I} = 0.026\) for 80 independent \(F_2 > 3F_2\) reflections shows the mineral is cubic, space group \(Fd\overline{3}m\). A = 10.3276(5) \text{ Å, } V = 1101.5 \text{ Å}^3, Z = 8. The holotype specimen is deposited in the Mineralogical Museum of St. Petersburg State University, Russia.

Oxytnamotricolite (IMA 2013-063), \((Na, Ca, U)\text{Ta}_2\text{O}_6\), was first found at Gauano (Lushchi county, Heman Province, China) in the No. 309 rare-metal granitic pegmatite vein in association with quartz, albite, potassium feldspar, muscovite, kaolinite, tantaillite-Mn, stibiotantalite, pollucite, spodumene, montebrasite, Hf-rich zircon, a red tourmaline, polythionite, trithionite, and luanshuiwite-2M. The new mineral is believed to have crystallized directly and primarily from a highly evolved acid magma or transitional magmatic-hydrothermal fluids enriched in volatile, flux, and lithophile elements. Oxytnamotricolite can be replaced secondarily by a more hydrated phase. Oxytnamotricolite crystals (0.05–0.20 mm) are mostly octahedral but also form rhombic prisms. The occurrence of the mineral is considered to be two different polytypes (50°24′26″N, 4°0′35″W) has shown them to be two different polytypes (3C and 6R) of hydrokioleosmoreite (HKE) with simplified formula \([Ca, Na, H_2O]_A (W, Fe)^{3+} (Al, Mg) (OH, O)\_2\text{H}_2O\). The upper part of the greisen zone W–Sn deposit of the Hemerdon mine is heavily altered and has produced a number of secondary minerals, i.e., scorodite, phacocasoditerite, and minor amounts of the tungstates russellite and “elasmolite” (often labelled as “ferri-” or “alumotungsite”). The platy habit of these specimens, despite their cubic (3C) or pseudocubic (6R) symmetry, suggests those are pseudomorphs after a non-cubic precursor phase (probably phyllotungsite or pittiginnie, which are considered as polymorphs of hydrokioleosmoreite). The averages of 15/7 electron probe WDS analyses of HKE-3C / HKE-6R [wt% (range)] are: \(W\_2O_3 77.49 (76.48–79.37)/70.15 (66.08–72.89), \text{K}_2O 0.15 (0–0.18)/0.12 (0.08–0.18), \text{TiO}_2 \text{n.d./0.06} (0.06–0.18), \text{Fe}_2O_3 5.83 (5.27–6.33)/1.87 (6.89–8.75), \text{Al}_2O_3 2.41 (2.15–2.85)/0.97 (0.26–1.74), \text{CaO} 0.49 (0.42–0.57)/0.58 (0.27–0.84), \text{BaO} 0.10 (0.06–0.16)/0.09 (0.06–0.15), \text{K}_2O 0.22 (0.17–0.25)/0.31 (0.19–0.37), \text{Na}_2O 1.97 (1.24–2.67)/1.57 (1.25–1.89), \text{H}_2O (by structure) 7.40 (7.14–7.60)/8.82 (8.25–9.45), total 96.08/90.85 (systematically low totals are due to dehydration under electron beam). The empirical formulas are \([Ca, Na, H_2O]_A (W, Fe)^{3+} (Al, Mg) (OH, O)\_2\text{H}_2O\) and \([Ca, Na, H_2O]_A (W, Fe)^{3+} (Al, Mg) (OH, O)\_2\text{H}_2O\), with \(a = 0.17–0.29, y = 0.49–0.63, z = 3–y\). The structures of HKE-3C and HKE-6R were solved by direct methods respectively in space group \(Fd\overline{3}m\) \([R_\text{I} = 0.0130\) for 121 \(F_2 > 4F_2\) reflections], \(a = 10.3065(3) \text{ Å, } Z = 16\) and in space group \(R3\_d\) \([R_\text{I} = 0.0196\) for 569 \(F_2 > 4F_2\) reflections], \(a = 7.2882(2) \text{ Å, } c = 35.705(4) \text{ Å, } Z = 9\). The periodicity in \(6R\) relative to the unique threefold axis of the 3C cubic structure is doubled due to \(Na\) and \(O\), \(H\_2O\) ordering in the \(A\) site; no long-range ordering is observed between \(W\) and Fe/A1 in the \(B\) site. In space group \(R3\_d\), there is considerable splitting of the sites of the cubic pychrochlor, the 6R structure can be represented as \((A1)\_2 (A2) (B1) (B2) (B3) (X1) (X2) (X3) (X4) (Y1) (Y2)\) D.B., O.C.G. References cited

\[\text{References cited}\]

\[\text{Atencio, D. (2016) Pararabiomarcolite discribed as identical to hydrogenokioleosmoreite-3R. Mineralogical Magazine, 80, 923–924.}\]


