New Mineral Names*†

FERNANDO CÁMARA¹, OLIVIER C. GAGNE², YULIA UVAROVA³ AND DMITRIY I. BELAKOVSKY⁴

¹Dipartimento di Scienze della Terrá, Università di degli Studi di Torino, Via Valperga Caluso, 35-10125 Torino, Italy
²Department of Geological Sciences, University of Manitoba, Winnipeg, Manitoba, R3T 3R1, Canada
³CSIRO Earth Science and Resource Engineering, MDU Flagship, ARRC, 26 Dick Perry Avenue, Kensington, Western Australia 6151, Australia
⁴Fersman Mineralogical Museum, Russian Academy of Sciences, Leninskiy Prospekt 18 korpus 2, Moscow 119071, Russia

IN THIS ISSUE

This New Mineral Names has entries for 12 new minerals, including adranosite-(Fe), calciodelrioite, d’anisite-(Mn), d’anisite-(Fe), ferrochiavennite, jasrouxite, kokinosite, peatite-(Y), piemontite-(Pb), rhabdophane-(Y), ramikite-(Y), and steedite. It also includes 3 entries of new data for cannonite, magbasite, and sinnerite.

ADRANOSITE-(Fe)*


Adranosite-(Fe) (IMA 2011-006), ideally (NH₄)₂NaFe₂(SO₄)₂Cl(OH)₆, is a new mineral found on a pyroclastic breccia in two different fumaroles at “La Fossa” crater of Vulcano, Aeolian Islands, Italy, previously observed as an anthropogenic product from a burning coal dump at the Anna mine near Aachen, North Rhine-Westphalia, Germany. It was named as the Fe⁺⁺ analog of adranosite, (NH₄)₂NaAl(SO₄)₂Cl(OH)₆ (the ancient god of fire Adrano, Αδράνως), which was also discovered at Vulcano (Demartin et al. 2010). It is associated with thermessaita, pseudocotunnite, and bismuthinite in a holotype specimen and with barberiite, salmoniacite, anhydrite, sassolite, and sulfur in a cotyote. Adranosite-(Fe) forms aggregates of acicular crystals up to 1 mm in length with a tetrahedral habit and no apparent twinning. The mineral is pale-yellow with a white streak, is vitreous and has perfect cleavage on {001}. The Mohs hardness was not measured; the density is 2.195 g/cm³.

The empirical formula is (NH₄)₂NaFe₂(SO₄)₂Cl(OH)₆. The structure consists of NaO₂Cl₄ square tetragonal bipyramids linked through their opposite Cl corners and helicoidal chains with composition [FeO₂Cl₄SO₄]₄₋, both of which extend along [001]. The sharing of the sulfate ions between the different chains result in cages that host the nine-coordinated hydrogen-bonded NH₄⁺ cations. The empirical formula is (NH₄)₂NaFe₂(SO₄)₂Cl(OH)₆. The structure consists of NaO₂Cl₄ square tetragonal bipyramids linked through their opposite Cl corners and helicoidal chains with composition [FeO₂Cl₄SO₄]₄₋, both of which extend along [001]. The sharing of the sulfate ions between the different chains result in cages that host the nine-coordinated hydrogen-bonded NH₄⁺ cations.

New Mineral Names*†


Reference cited


* All minerals marked with an asterisk have been approved by the IMA CNMMC.
† For a complete listing of all IMA-validated unnamed minerals and their codes, see http://pubsite.sites.uws.edu.au/ima-cnmmc/.
Calciodelrioite (IMA 2012-031), ideally Ca(VO$_3$)$_2$(H$_2$O)$_6$, is a new mineral form the uranium-vanadium deposits of the eastern Colorado Plateau in the U.S.A. It was first found as a moderately rare mineral at the West Sunday mine, Slick Rock district, San Miguel County, Colorado. It was subsequently found at the adjacent St. Jude mine in the Slick Rock district, at the Blue Streak mine, Bull Canyon, Montrose County, Colorado, and at the Little Eva mine, Yellow Cat district, Grand County, Utah, U.S.A. Calciodelrioite occurs as crystalline crust on fracture surfaces on corvusite- and montroseite-impregnated sandstone as the result of the oxidative alteration of both vanadium minerals. It is associated with gypsum, rossite, metarossite, and also with celestine, huemulite, and pascoite (West Sunday mine); delrioite, henderssonite, pascoite, powellite, and schindlerite (St. Jude mine); delrioite, huemulite, hummerite, magnesiopascoite, powellite, and a K- and Mg-bearing decavanadate under study (Blue Streak mine); huemulite (Little Eva mine). In all almost specimens from these localities Ca was dominant over Sr (delrioite). The mineral occurs as three different appearances: (1) transparent colorless needles typically forming parallel-to-subparallel intergrowths or divergent sprays up to about 1 mm in length; (2) tan to brown to reddish brown needles forming bundles of parallel crystals up to about 2 mm in length; (3) brownish needles intergrown very tightly to create apparently black broad blades in flat-lying “star bursts” up to about 2 mm across. Needles are elongated parallel to [100] with common steps or striations parallel to their length. Prismatic forms are approximated as {100} and {011} and gave the average composition [wt% (range)]: d’ansite-(Mn) Na$_{0.98}$ (67.42–71.62), V$_2$O$_5$ 17.052(2), and $V = 1690\,\text{Å}^3$ (Z = 8). Structure determination was done on a crystal of sample 63837. The single crystal parameters of the monoclinic unit cell are: $a = 14.6389(10), b = 6.9591(4), c = 17.052(2)\,\text{Å}, \beta = 102.568(9)^\circ$, and $V = 1695.5\,\text{Å}^3$, space group $I2/a$. Model refined to an agreement factor of $R = 3.14\%$ for 1216 $F_i > 4\sigma F_i$. In the structure of calciodelrioite V$_5$O$_{13}$ polyhedra link by sharing edges to form a zigzag divanadate [VO$_3$] chain along a, similar to that found in the structure of rossite. The chains are linked via bonds to Ca atoms, which also bond to H$_2$O groups, yielding CaO$_2$(H$_2$O)$_9$, polyhedra, which form chains along b. Each of the two symmetrically independent VO$_3$ polyhedra has two short vanadyl bonds and three long equatorial bonds. Calciodelrioite is isostructural with delrioite and form a continuous series Ca(VO$_3$)$_2$(H$_2$O)$_6$–Sr(VO$_3$)$_2$(H$_2$O)$_6$. Calciodelrioite is dimorphous with rossite. The new mineral is named calciodelrioite, as it is the Ca analog of delrioite. The cotypes are deposited in the collections of the Natural History Museum of Los Angeles County under catalog numbers 63837, 63838, and 63839. F.C.

D’ANSITE-(MN)* AND D’ANSITE-(FE)*
F. Demartin, I. Camportostrini, C. Castellano, C.M. Gramaccioli, and M. Russo (2012) D’ansite-(Mn), Na$_2$Mn$_{21}$Z$^{6+}$(SO$_4$)$_{41}$Cl$_3$, and d’ansite-(Fe), Na$_2$Fe$_{21}$Z$^{6+}$(SO$_4$)$_{41}$Cl$_3$, two new minerals from volcanic fumaroles. Mineralogical Magazine, 76(7), 2773–2783.

D’ansite-(Mn) (IMA 2011-064) ideally Na$_2$Mn$_{21}$Z$^{6+}$(SO$_4$)$_{41}$Cl$_3$ and d’ansite-(Fe) (IMA 2011-065) ideally Na$_2$Fe$_{21}$Z$^{6+}$(SO$_4$)$_{41}$Cl$_3$, are two new minerals found at Vesuvius, Naples, Italy, and La Fossa crater, Vulcano, Aeolian Islands, Italy, respectively. They occur as encrustations on a pyroclastic breccia in fumaroles. D’ansite-(Fe) was collected in 2008 in an intracrater fumarole with a temperature of about 300 °C at La Fossa Crater and was previously described (Camportostrini et al. 2011) as unknown species. D’ansite-(Mn) was collected in May 1927 by A. Malladra in a 1926 eruption fumarole at Vesuvius, Naples, with a temperature of about 350 °C. The minerals were named as Mn- and Fe-dominant analogs of d’ansite Na$_2$Mg(SO$_4$)$_{3}$Cl$_3$. D’ansite-(Mn) forms colorless translucent tristetrahedral crystals up to 0.2 mm on edge associated to halite and aphthitalite. D’ansite-(Fe) forms aggregates of colorless to white complex isometric crystals up to 0.2 mm, associated with sassoilite, adranosite, and sulfate-chlorides under investigation. Both minerals have a white streak and a vitreous luster, and neither is tenacious. Their hardness was not determined, their tenacity is brittle, and no cleavage is evident. D’ansite-(Mn) is optically isotropic with $n = 1.50(1)$ and d’ansite-(Fe) is optically isotropic with $n = 1.51(1)$ (589 nm). $D_{calc} = 2.610$ for d’ansite-(Mn) while for d’ansite-(Fe) $D_{min} = 2.621(1)$ and $D_{calc} = 2.644\,\text{g/cm}^3$. The chemical composition was obtained by electron probe WDS analyses and gave the average composition [wt% (range)]: d’ansite-(Mn) (mean of 6 analyses) Na$_2$O 39.37 (38.47–40.20), MnO 3.46.
NEW MINERAL NAMES

(3.83–3.62), MgO 0.13 (0.06–0.18), SO₃ 49.99 (49.22–50.68), CI 6.36 (6.20–6.63), O=C 1.14, total 97.87; d’ansite-(Fe) (mean of 8 analyses) Na₂O 39.12 (38.49–41.05), MnO 4.18 (3.91–4.35), MgO 0.12 (0.07–0.18), SO₃ 49.91 (49.56–61.68), CI 6.81 (6.28–7.42), O=C 1.54, total 98.60. The empirical formula derived from chemical analysis on the basis of 43 anions pfu is for d’ansite-(Mn) Na₂0.65(Mn₄0.99Mg₀.02)₀.₀298S₁₀.₀₁O₁₀.₀₅Cl₋₀.₉₁ and for d’ansite-(Fe) Na₂0.₄₅(Fe₀.₄₂Mn₀.₀₈)₀.₀₁₉₀S₁₀.₀₉Or₀.₀₈CI₁.₁. The simplified formula of d’ansite-(Mn) is Na₂Mn₂Clₓ(SO₄)ₓCl₁₋ₓ and of d’ansite-(Fe) is Na₂Fe₂Clₓ(SO₄)ₓCl₁₋ₓ. The X-ray powder diffraction data for d’ansite-(Fe) were collected using a Rigaku D-MAXII diffractometer with CuKa radiation and the refined unit-cell parameter is a = 15.8842(7) Å; the powder pattern of d’ansite-(Mn) could not be measured due to the extreme scarcity of material and the pattern calculated from single crystal X-ray data. The strongest lines in the X-ray powder-diffraction pattern for d’ansite-(Fe) [d_{obs} Å (hkl)] are: 2.816 (100; 044), 2.570 (37; 235), 1.714 (29; 129), 3.384 (27; 233), 3.113 (26; 134), 2.108 (15; 237). The strongest lines calculated for d’ansite-(Mn) [d_{obs} Å (hkl)] are: 2.816 (100; 044), 3.396 (95; 233), 3.124 (45; 134), 2.584 (38; 235), 3.982 (35; 004), 4.257 (30; 123). Single crystal diffraction intensities were collected using a Bruker Apex II diffractometer equipped with a 2K CCD detector and MoKa radiation. As no violations of the extinction rules for the F3d space group were present, the crystal structure of both minerals was solved by direct methods and refined to R₁ = 3.09% based on 1287 reflections for d’ansite-(Mn) and to R₁ = 3.36% based on 407 reflections for d’ansite-(Fe). Lattice parameters obtained from single crystal diffraction data are a = 15.9291(9) Å, V = 4041.8 Å³, Z = 4 and a = 15.882(3) Å, V = 4006 Å³, for d’ansite-(Mn) and d’ansite-(Fe), respectively. The structure contains three independent Na sites, one of which is partially occupied by Mn²⁺ or Fe²⁺, two independent sulfate anions, and one chlorine site. The holotype specimen of d’ansite-(Mn) is deposited in the mineral collections of the Osservatorio Vesuviano, Naples (under catalog number OV128). The crystal fragment used for the structure determination is housed in the reference collection of the Dipartimento di Chimica at the Università degli Studi di Milano (catalog no. 2011-03) together with the type specimen of d’ansite-(Fe) (catalog no. 2011-02). F.C.

Reference cited

**Ferrochiavennite**


Ferrochiavennite (IMA 2012-039), ideally Ca₁₋₃Fe Si₆BeO₁₀(OH)·2H₂O, is a new mineral found at two syenite pegmatite localities in Norway: (1) Bláfjell, Langangen, Telemark, and (2) the AS Granit larvikite quarry, Tvedalen, Vestfold. In locality 1, ferrochiavennite is associated with albite, magnetite, and fayalite, with minor amounts of zircon, nepheline, analcime, pyrite, and hambergite. It occurs in small vugs in masses of analcime associated with hambergite at locality 2, with other late-stage minerals including tvedalite, aphyllitite-(KF), natrolite, gonnardite, pale yellowish white chiavennite, epidysrite, behoite, calcite, chlorite, aegirine, catapleiite, gaidonnayite, neotocite, fluorate, and molybdenite. Crystal aggregates of ferrochiavennite form spherules up to ~2 mm in diameter (locality 1). Individual crystals reach 0.2 × 0.2 × 0.2 mm in size, are platy on {001} and spear-shaped along [100]. In locality 2, spherules are up to 1 mm across, but the individual crystals are significantly smaller than at locality 1. Ferrochiavennite is beige to pale-yellow in locality 1, pale-green in locality 2, has a white streak and is vitreous to translucent. It is brittle with uneven fracture and shows no cleavage. The Mohs hardness is ~3; D_{calc} = 2.67(2) and D_{meas} = 2.709 g/cm³ for locality 1. Ferrochiavennite is non-fluorescent in long- and short-wave ultraviolet radiation. It is biaxial (+) with α = 1.583(1), β = 1.589(1), γ = 1.602(1), 2V_{meas} = 62(4)°, 2V_{calc} = 69°. The optical orientation is X ~ a, Y ~ c, and Z ~ b. Ferrochiavennite is nonpleochroic and dispersion could not be measured. The average of 10 electron-microprobe WDS analysis for a specimen of locality 1 gives [wt% (range)]: SiO₂ 46.00 (44.06–49.12), Al₂O₃ 4.64 (3.97–6.28), FeO 5.29 (3.64–6.99), MnO 4.04 (2.60–5.06), MgO 0.13 (0.09–0.17), CaO 17.62 (10.50–24.32), Na₂O 0.73 (0.50–0.86), K₂O 0.02 (0.01–0.03), BeO 10.37, H₂O 9.81, total 98.65 wt%. Fluorine was below detection limits and H₂O and BeO were calculated by stoichiometry from the results of the crystal structure analysis. The empirical formula calculated on the basis of 17 anions and 7 cations in tetrahedral sites pfu is, (Ca₁₋₃Na₆₈K₁₂)₀.₃₈₉(Fe₀.₄₁Mn₀.₃₁Mg₀.₀₂O₂H₂O)(Si₃₂Al₁₀₅Be₂₃₂₇O₁₆(OH)₂)·2H₂O. The average of 7 electron microprobe WDS analysis for a specimen of locality 2 gives [wt% (range)]: SiO₂ 46.41 (42.82–48.76), Al₂O₃ 2.76 (1.83–3.78), FeO 9.94 (8.25–10.83), MnO 3.53 (2.33–4.93), CaO 12.23 (10.94–14.56), Na₂O 1.00 (0.58–1.68), K₂O 0.02 (0.01–0.04), BeO 9.91, H₂O 9.44, total 95.24 wt%. The empirical formula calculated on the same basis is (Ca₁₋₃Na₆₈Mn₀.₀₉8Be₀.₀₉8)₀.₂₁₂₃(Si₃₂Al₁₀₅Be₂₃₂₇O₁₆(OH)₂)·2H₂O. The strongest reflections of the X-ray powder-diffraction pattern [d_{obs} Å (hkl)] are: 15.555 (100; 002), 4.104 (29; 12,112), 3.938 (36; T13,113), 3.909 (60; 008), 3.820 (30; 204,204), 3.251 (66; 017,210,211), 3.186 (27; Z12,212,212), 2.884 (64; Z15,215). The unit-cell parameters refined from powder-diffraction data are: a = 8.759(5), b = 4.864(2), c = 3.125(6) Å, β = 90.31(6)°, V = 1311.7 Å³, and Z = 4, space group P2₁/c. Single-crystal X-ray diffraction data collected on a crystal of size 0.01 × 0.03 × 0.04 mm refined to R₁ = 0.048 for 3651 unique reflections with I ≥ 4σ(I) shows ferrochiavennite is monoclinic, space group P2₁/c, with a = 8.7499(5), b = 4.9160 (3), c = 31.43(2) Å, β = 90.1574(9)°, V = 1352.0 Å³, and Z = 4. Ferrochiavennite is essentially isosstructural with chiavennite, hence the name. The uninterrupted zeolite structure consists of intersecting channels of nine-, six-, five-, and four-fold rings, where the tetrahedral framework consists of seven tetrahedrally coordinated sites that are dominantly occupied by Si and Be. The holotype material is preserved in the Canadian Museum of Nature, Ottawa, Canada, and the Department of Geology, Natural History Museum, University of Oslo. O.C.G.
JASROUXITE*


Jasrouxite (IMA 2012-058), ideally Ag10Pb(Sb2As15S28)2, is a new mineral from the thallium-rich sulfosalts deposit of Jas Roux, in Pelvoux Massif, France, and was named after the locality where it was discovered. Jasrouxite formed at the early Pb-containing stage of the TI-As-Sb mineralisation. Grains of jasrouxite are covered by a three-phase myrmekite aggregate composed of stibnite, boscardinite, and smithite in intergrowth, and are also associated with pyrite, sphaerelite, and other lead sulfosalts. Jasrouxite is gray, opaque, has metallic luster and gray streak. It forms anhedral crystals up to a few millimeters in size or aggregates of crystals up to 10 mm in diameter. Jasrouxite is brittle, has irregular fracture, and no cleavage or parting. The density cannot be measured as the material is scarce. Dcalc = 4.87 g/cm³. In reflected light, jasrouxite is white and has weak pleochroism between white and whitish creamy. It is anisotropic with rotation tints vary between pale bluish green and pale greenish blue. No internal reflections observed. The reflectance decreases from 400 to 700 nm with a 5% difference. The interplanar spacings (in air) for COM wavelengths [Rmin, Rmax (nm)] are: 30.4, 35.1 (470); 29.8, 34.7 (546); 29.1, 34.1 (589); 28.2, 33.1 (650). The average of 12 electron microprobe analyses (wt%) collected on two grains of jasrouxite gave: Cu 0.55, Ag 17.52, Pb 9.44, Ti 0.10, As 12.77, Sb 33.61, S 25.77, total 99.67. The empirical formula calculated on the basis of 132 apfu is Cu₀.₇₅Ag₁₀.₄₈Pb₀.₁₀Ti₀.₅₁As₁₅.₈₅Sb₂₈.₄₂S₃₂.₂₈. The strongest lines in the calculated powder diffraction pattern [dcalc Å (hkl)] are: 3.847 (33; 023), 3.294 (80; 053), 3.281 (100; 053), 2.8602 (33; 065), 2.8498 (26; 063). The crystal structure of jasrouxite determined on the basis of 14000 reflections refined to R = 6.0%. The mineral is triclinic, PT₅, a = 8.2917(5), b = 19.101(1), c = 19.487(1) Å, α = 89.731(1), β = 83.446(1), γ = 89.944(1)°, V = 3066.1 Å³, and Z = 1. Jasrouxite is a member of the lillianite homologous series, with a supercell based on a lillianite subcell. There are 30 independent cation sites and 36 independent sulphur sites. The parameter a is doubled, and b is about 3/2 of a diagonal to (001) of lillianite. Lone-pair-electron-pair micelles in jasrouxite slabs are of a large type, rich in Sb and As. In the lillianite homologous series, jasrouxite has the order number of 4, and degree of Ag + (Sb,As) ↔ 2 Pb substitution for the new mineral is 36.5% above the theoretical 100% substitution expressed as PbAg(Sb,As)₂. Jasrouxite is also distinguished by considerable replacement of Pb by Sb in trigonal prismatic sites, and high contents of Ag and (Sb,As). Holotype material is deposited in the collections of the Department of Materials Engineering and Physics, University of Salzburg, Austria. Cotype specimens are deposited in the Collection des Mines de Jussieu, IMPMC, Université Pierre et Marie Curie, France, and in the collections of Museum of Mineralogy, Mines Paris Tech, France. Yu.U.

KOKINOSITE*


Kokinosite (IMA 2013-099), ideally Na₂Ca₄(V₁₀O₃₂)·24H₂O, is a new mineral found in the St. Jude mine, Gypsum Valley, Slick Rock district, San Miguel County, Colorado, U.S.A. The mineral was found growing on a corvusite-montroseite-bearing sandstone block closely associated with gyspum, huemulite, metarossite, pascoite, rossite, and wernerbaurite. Other minerals found in the same area include calciocheiroleite, delrioite, hender-sonite, hughesite, nashite, powellite, postite, and schindlerite. Kokinosite forms from the oxidation of montroseite-corvusite assemblages in a moist environment. It typically occurs as tablets or blades up to 0.05 mm in thickness, with stepped faces, up to 1 mm in the longest dimension, but also as larger irregularly stepped crystal masses up to several millimeters across. Kokinosite is yellow orange, sometimes has an orange-brown tint, has a yellow streak, a subadamantine luster, is transparent, and has a yellow tint, has a yellow streak, a subadamantine luster, is transparent, and shows no parting. Mohs hardness is approximately 1½. The density of kokinosite could not be measured due to its dissolution in density liquids; Dcalc = 2.35 g/cm³. It is non-fluorescent in long- and short-wave ultraviolet radiation, is biaxial (-) with α = 1.725(3), β = 1.770(5), and γ = 1.785(3). 2Vmeas = 56.6(3), and 2Vcalc = 58.7°. Dispersion is r < v, moderate, X' > a = 15°, Y ≈ b.

The mineral is pleochroic: X, Z = orange-yellow, Y = orange, and X' = Z < Y. The average of 10 electron-microprobe WDS analysis on 3 crystals gives (wt% range): Na₂O 4.64 (3.78–5.95), K₂O 0.04 (0.02–0.07), CaO 8.08 (6.39–9.91), SrO 1.01 (0.52–2.54), V₂O₅ 72.43 (70.66–74.08), total 86.20 wt%. The low wt% is due to partial dehydration under the vacuum of the microprobe chamber. The loss of H₂O results in higher concentrations for the remaining constituents than are expected for the fully hydrated phase; as not enough material was available for a direct measurement of H₂O, its content was calculated by stoichiometry and the analyzed constituents (above) were subsequently normalized. The resulting empirical formula, calculated on the basis of V = 10 and O = 52 apfu, is (Na₃.₃₈K₀.₀₂)·(Ca₄.₃₅Sr₂.₆₁)·(V₁₀O₃₂)·24H₂O (V₁₀O₃₂)·24H₂O. The strongest lines in the diffraction pattern [dobs Å (hkl)] are: 9.88 (100; 010; 011), 7.92 (36; 011), 8.42 (33; 100) and 6.01 (31; 111). Single-crystal X-ray diffraction data collected on a crystal of size 0.12 × 0.03 mm refined to R = 0.0379 for 3806 unique reflections with I > 4σ(I) shows kokinosite is triclinic, space group P'T₅, with a = 8.74899(19), b = 10.9746(3), c = 12.8216(9) Å, α = 114.492(8), β = 105.093(7), γ = 91.111(6)°, V = 2440 Å³, and Z = 1. The structural unit of kokinosite is the decavanadate polyanion, (V₁₀O₃₂)₆⁻, consisting of ten distorted VO₆ octahedra, making it a member of the pascoite family. The interstitial unit [Na₂Ca₄(H₂O)₁₃]⁰ keeps charge balance in the structure and consists of Na(H₂O)₂ octahedra and Ca(H₂O)₆ polyhedra that link into chains by edge- and corner-sharing. The structural and interstitial units are solely linked by...
hydrogen bonding. Kokinosite is named in honor of Michael (Mike) Kokinos (b. 1927) of Shingle Springs, California, U.S.A., member of the Micromounters’ Hall of Fame, for his collecting work and his role as a mentor in the collecting community. Six cotype specimens of kokinosite are deposited in the collections of the Natural History Museum of Los Angeles County, Los Angeles, California, U.S.A. O.C.G.

**Peatite-(Y)** and Ramikite-(Y)*


Peatite-(Y) (IMA 2009-020), ideally LiNa$_2$(YNa$_3$Ca$_3$HREE)$_3$(PO$_4$)$_2$(CO$_3$)$_3$(F,OH)$_8$, and ramikite-(Y) (IMA 2009-021), ideally Li$_4$Na$_{28}$Ca$_{22}$HREE$_{12}$Zr$_2$(PO$_4$)$_9$(CO$_3$)$_3$O$_{12}$F(OH)$_8$, are two new Na-Li-Y-Zr phosphate-carbonate minerals from the Poudrette pegmatite, Mont Saint-Hilaire, Quebec. They are named after Cynthia Peat, a former X-ray technician at the Royal Ontario Museum, Toronto, Canada, an avid mineralogist who spent a lot of decades studying the mineralogy of Mont Saint-Hilaire, and Robert Ramik, a thermoanalytical technician and mineralogist at the Royal Ontario Museum. Both minerals occur as epitectic intergrowths with peatite-(Y) forming rims and ramikite-(Y) being in the core of these intergrowths. Peatite-(Y) occurs as thin, colorless, pale pink to purple overgrowths on ramikite-(Y) crystals, which are yellowish and translucent. Peatite-(Y) and ramikite-(Y) occur as free-standing crystals overgrowing albite and Mn-Fe carbonates and, less commonly, chabazite-Na, synchysite-(Ce), and sabinaite. Rarely, they were observed as inclusions in chabazite-(Na). Peatite-(Y) has very good {100}, {010}, and {001} cleavages, and ramikite-(Y) has no distinct cleavage. Peatite-(Y) has a brittle fracture, while ramikite-(Y) cores exhibit splintery fracture. Peatite-(Y) has a vitreous luster and ramikite-(Y) has luster between vitreous and dull. Mohs hardness for both minerals is 3. $D_{	ext{obs}} = 3.62(1)$ g/cm$^3$ for peatite-(Y) and $D_{	ext{calc}} = 3.60(1)$ g/cm$^3$ for ramikite-(Y). Both minerals are non-pleochroic, with no discernible dispersion. The optic sign and $2V'$ could not be obtained due to the poor quality of samples. One refractive index was measured; $\beta = 1.601(1)$ in peatite-(Y) and $\beta = 1.636(1)$ in ramikite-(Y) ($\lambda = 589$ nm). The average of 4 electron probe analyses on peatite-(Y) gives [wt% (range)]; Na$_2$O 12.95 (12.50–13.30), CaO 1.15 (0.98–1.51), Y$_2$O$_3$ 37.32 (37.01–37.52), Gd$_2$O$_3$ 0.61 (0.54–0.74), Dy$_2$O$_3$ 3.08 (2.91–3.44), Ho$_2$O$_3$ 0.67 (0–1.02), Er$_2$O$_3$ 2.88 (2.59–3.15), Tm$_2$O$_3$ 0.28 (0–0.40), Yb$_2$O$_3$ 1.78 (1.67–1.92), ZrO$_2$ 0.67 (0.63–0.70), ThO$_2$ 0.37 (0–0.56), P$_2$O$_5$ 27.29 (27.09–27.64), F 4.35 (4.03–4.62), O=F 1.83; with calculated amounts for CO$_2$ 5.79, H$_2$O 0.31, and Li$_2$O 1.96, the total is 99.75 wt%. The empirical formula of peatite-(Y) is calculated on the basis of 68 anions is Li$_4$(Na$_{0.70}$Ca$_{12}$)$_{33}$(Y$_{1.4}$Ca$_{0.99}$ D$_{10.18}$Er$_{0.10}$Yb$_{0.08}$La$_{0.05}$Ce$_{0.02}$Nd$_{0.01}$)$_{12}$X$_{3.81}$(Zr$_{6.65}$Hf$_{0.10}$Th$_{0.04}$)$_{23.81}$[(P$_{0.46}$Al$_{0.34}$)$_{0.30}$O$_{12}$]$(CO$_3$)$_3$(OH)$_{0.03}$F$_{0.97}$[X$_3$]. The strongest lines on the X-ray powder-diffraction pattern [d$_{\text{calc}}$, A ($\lambda_{\text{CuK}a}$; hkl)] for peatite-(Y) are: 4.56 (57; 211,121,112), 3.95 (57; 220,202,222), 3.54 (46; 310,301,130), 2.99 (83; 321,312,231), 2.63 (100; 330,303,033), 2.149 (42; 333), and for ramikite-(Y) are: 11.04 (76; 0\overline{7}0,100,00\overline{7}), 7.80 (79; 0\overline{1}1,110,111), 6.36 (75; 1\overline{1}T,1\overline{1}T,1\overline{1}T), 3.89 (100; 0\overline{2}2,200,202), 2.94 (98; 132,123,23T), 2.59 (98; 033,330,303). The crystal structures of both minerals were solved by direct methods and refined to $R_1 = 3.60\%$ for peatite-(Y) and $R_1 = 5.13\%$ for ramikite-(Y). Peatite-(Y) is orthorhombic, $P2_2_2_2$, $a = 11.167(2)$, $b = 11.164(2)$, c = 11.162(2) Å, $V = 1391.7$ Å$^3$, and $Z = 1$; while ramikite-(Y) is triclinic, $P1$, $a = 10.9977(6)$, $b = 10.9985(6)$, $c = 12.387(1)$ Å, $\alpha = 90.075(4)$, $\beta = 89.984(4)$, $\gamma = 89.969(4)$, $V = 1330.1$ Å$^3$, and $Z = 1$. The minerals are not isostructural but their structures are very similar and are governed by $M\#8$ polyhedra, where $M = Y$, Zr and $\phi$ = unspecified ligand. These polyhedra are linked into six-membered, edge- or corner-sharing clusters, which are joined together by PO$_4$ tetrahedra. Both LiO$_4$ octahedra and CO$_3$ groups are located within the corner-sharing clusters. Linked polyhedra form an open framework structure, and Na atoms occupy the resulting cavities. Peatite-(Y) and ramikite-(Y) are paragenetically late-stage products, and are possibly related to the in situ alteration of the pre-existing mineral assemblage present in the core of the Poudrette pegmatite. Holotypes are deposited in the Royal Ontario Museum, Toronto, Canada, with a specimen numbers of M53894 for peatite-(Y), and M53893 for ramikite-(Y).

**Piemontite-(Pb)**


The new epidote-supergroup mineral piemontite-(Pb) (IMA 2011-078), the Pb-dominant analog of piemontite, ideally CaPbAl$_2$Mn$_{10}$[Si$_2$O$_7$][SiO$_2$]OH(OH) was described in the pre-Cambrian dolomitic marbles and baryte shists of “Mixed Series” formation, near Nežilovo village, Jacupica Mountains, Macedonia. Its potential presence in metamorphic rocks of Nežilovo was mentioned based on electron probe analysis (Jančev 1997). Piemontite-(Pb) was considered as a theoretical member in the recommended nomenclature of the epidote group (Armbruster et al. 2006). The new mineral is associated with barite, dolomite, calcite, hematite, cynrite, Zn- and Mn-bearing phlogopite, intermediate members of epidote-(Pb)–epidote–piemontite series, hedyphane, nežilovite, rimmanite, gahnite, tilasite, rutile, Zn-rich
new mineral found at the Higashimatsuura alkaline olivine basalt, but it is not associated to rhabdophane-(Y) in the same druse. Rhabdophane-(Y) is yellowish white to yellowish brown and translucent, with yellowish white streak. It has silky to dull luster. Density: 4.54 g/cm³. Because of the small amount of mineral available no other physical and optical properties could be measured. The average of 9 electron probe WDS analyses gives [wt% (range)]: Y₂O₃ 15.25 (14.35–16.37), La₂O₃ 20.76 (18.29–23.76), CeO₂ 1.10 (0.44–2.34), Pr₂O₃ 5.28 (4.36–6.33), Nd₂O₃ 14.73 (13.43–15.98), Sm₂O₃ 0.33 (0.00–0.86), Gd₂O₃ 4.02 (3.72–4.45), CaO 2.03 (1.78–2.45), P₂O₅ 27.98 (25.56–30.43), H₂O 8.52 (by difference); total 100 wt%. On the basis of 4 anions pfu, the empirical chemical formula is (Y₃₋ₓLaₓ₋₅₋ₓNdₓ₋₂₋₅₋ₓCaₓ₋₅₋ₓPₓ₋₅₋ₓO₁₀₋ₓ·0.7H₂O (x = 0.02). The trivalent lines in the X-ray powder-diffraction pattern [d(obs); λ (Iα; kα)] are: 2.821 (100; 102), 3.013 (77; 200), 6.026 (76; 100), 4.385 (47; 101), 3.480 (44; 110), 2.127 (28; 003), 1.854 (24; 212). The unit-cell parameters obtained from the powder-diffraction experiment are a = 6.959(2), c = 6.384(2) Å, V = 267.7 Å³.

Rhabdophane-(Y) is hexagonal and crystallizes in space group P6₃22. Rhabdophane-(Y) belongs to the rhabdophane-group minerals, which includes rhabdophane-(La), rhabdophane-(Ce), rhabdophane-(Nd), grayite (hydrated Th phosphate), tristramite (hydrated U-Ca phosphate), and brockite (hydrated Ca-Th phosphate). The lattice parameters of rhabdophane-(Y) are slightly larger than those of its synthetic equivalent (Y₃₋ₓLaₓ₋₅₋ₓNdₓ₋₂₋₅₋ₓCaₓ₋₅₋ₓPₓ₋₅₋ₓO₁₀₋ₓ·0.7H₂O (x = 0.02), due to its lower Y content. Rhabdophane-(Y) is named according to the Levinson rule as the Y-dominant species of rhabdophane-(Ce). The holotype specimen of rhabdophane-(Y) is deposited at the Kitakyushu Museum of Natural History and Human History, Kitakyushu, Japan under the registered number KMNHM000002. F.C.

**STEEDEITE**

M.M.M. Haring and A.M. McDonald (2014) Steedeite, NaMn₂[Si₂BO₅(OH)$_2$]: Characterization, crystal-structure determination, and origin. Canadian Mineralogist, 52, 47–60.

Steeideite (IMA 2013-052), ideally NaMn₂[Si₂BO₅(OH)$_2$], is a new mineral found at the Poudrette quarry, La Vallée-du-Richelieu, Montérégie (formerly Rouville County), Québec, Canada. Steedeite was found in radiating to loose, randomly oriented groupings (~1 cm in diameter) within vugs in a loose bole (~1–1 m) of sodalite syenite, associated with microcline, albite, nepheline, aegirine, pyrrhotite, sodalite, eudialyte-group minerals, natron, catapleite and two other unidentified minerals. Steedeite precipitated from late-stage aqueous fluids that are inferred to have been highly alkaline due to the presence of late-stage natrite. Crystals of steedeite are euhedral, acicular, and elongate along [001] with average dimensions of 0.006×0.01×0.5 mm. The dominant form is pinacoid {100}, and minor forms include pinacoids {010} and {001}. Steedeite is colorless to pale pink with a white streak, are vitreous, transparent to translucent, shows no parting or cleavage and exhibit an uneven fracture. The
Mohs hardness and density could not be measured due to small crystal size; $D_{\text{min}} = 3.106$ g/cm$^3$. Steeedite does not effervesc in 10% HCl at room temperature. The mineral shows a weak pale green to pale yellow fluorescence under medium-wave radiation. It is assumed to be a biaxial, based on its symmetry, but full optical characterization could not be done due to the small size of the crystals. Steeedite shows a positive elongation and refractive indices of $n_{\text{min}} = 1.636(2)$ and $n_{\text{max}} = 1.656(2)$, and is nonpleochroic. The Raman spectrum shows wide bands at 3250–3500 cm$^{-1}$ (O–H stretching), strong and sharp bands at 575–750 and 825–1075 cm$^{-1}$ (Si–O bonds, also possibly B–O bonds), and weak to strong electron-microprobe EDS analysis on 7 crystals gives [wt% (range)]: Na$_2$O 7.51 (6.78–8.32), CaO 0.17 (0.08–0.22), MnO 31.02 (29.91–32.83), FeO 0.86 (0.76–1.01), SiO$_2$ 46.34 (40.39–49.29), S 0.39 (0.2–2.36), B$_2$O$_3$ (calc) 8.73, and H$_2$O (calc) 4.52, total 99.53 wt%. Values for B and H$_2$O were determined by crystal-structure refinement and their presence confirmed by Raman spectroscopy. The empirical formula calculated on the basis of 11 anions is Na$_{0.09}$Mn$_{1.4}$Fe$_{0.02}$Ca$_{0.01}$Si$_{2.5}$O$_{5.8}$ (Si–O bonds, also possibly B–O bonds). The strongest reflections of the X-ray powder-diffraction pattern $d_{\text{calc}}, \bar{\AA}$ ($I_{\text{calc}}$: %) are: 8.454 (100; 00T), 7.234 (39; 00T), 3.331 (83; 121,0T, 20T, 1T2), 3.081 (38; 02T), 2.859 (52; 0T3), and 2.823 (80; 21T). Single-crystal X-ray diffraction data refined to $R_1 = 0.0168$ for 2409 unique reflections with $I > 4\sigma(I)$ shows steeedite crystallizes in space group $P1$, with $a = 6.837(1)$, $b = 7.575(2)$, $c = 8.841(2)$ Å, $\alpha = 99.91(3)$, $\beta = 102.19$, $\gamma = 102.78(3)$, $\gamma'$ = 424.81 Å$^{-1}$, and $Z = 2$. The structure of steeedite is based on corner-sharing silicate chains with a periodicity of three (i.e., dreier chain) in a C-shape, closed by BO$_4$(OH)$_2$ tetrahedra to form four-membered borosilicate rings of composition [BSi$_2$O$_4$(OH)$_2$]$^{12-}$. The clusters are linked together through shared corners to bands of edge-sharing MnO$_6$(OH) octahedra, where the resulting framework contains channels along (011) that are occupied by Na. Steeedite is the first mineral found to contain single loop-branched dreier silicate chains. The mineral is named after Anthony Hosford Steede (b. 1940) in recognition of his contribution to the understanding of the mineralogy of Mont Saint-Hilaire. The holotype material of the mineralogy of Mont Saint-Hilaire. The holotype material of Semenov but reported a different chemical formula: $\text{B}_{2} \text{O}_{3} \text{SO}_{4} \text{OH}_{2}$. Steedeite is the first mineral found to contain single loop-branched dreier silicate chains. The mineral was approved by IMA with a chemical formula $\text{Bi}_{2} \text{O}_{3} \text{SO}_{4} \text{OH}_{2}$ from Alfenza (Cordo, Italy): crystal structure and morphology. Mineralogical Magazine, 77(8), 3067–3079.

First noted in Cu-Bi-S mineralization in the Ohio Mining District, Marysville, Utah, U.S.A., by Radkte et al. (1967), cannonite [Bi$_2$(O$_2$SO$_4$)OH$_2$] was described as a new mineral well later (Stanley et al. 1992). Its structure was known from synthetic analogs only. Reported identification of cannonite in few other localities based on EDS analysis is uncertain since could be misidentified with riomarinite [Bi(OH)$_2$SO$_4$H$_2$O] and baličžunicaite [Bi$_2$O$_3$(SO$_4$)$_2$]. Cannonite found in mineralized quartz dykes intruding garnet micaschist cropping out near Alfenza (Cordo, Italy) and grows as crowded, radiating, acicular aggregates of (010) “scalpel-like” habit crystals up to a few millimeters covering bismuthinite. Other associated minerals are pyrite, arsenopyrite, cosalite, bornite, anglesite, micas, and other two Bi oxysulfates under study. The average of 10 electron probe WDS analyses of cannonite gives [wt% (range)]: Bi$_2$O$_3$ 77.87 (74.71–81.12), SO$_2$ 14.33 (12.40–15.47), F 0.28 (0.15–0.39), O–F 0.23, total 92.35 leading to empirical formula $\text{Bi}_{2} \text{O}_{3} \text{SO}_{4} \text{OH}_{2}$,$\text{Fe}_{0.00}$ based on 7 anions pfu. No other elements detected by WDS. The sublimation due to beam damage was blamed for a low total. The most intense bands at Raman spectrum (cm$^{-1}$, $s$ = strong, $m$ = medium) are: 3439, 3376, 3190 (O–H-stretching vibrations), 1114, 1059, 984 (SO$_4$ stretching), 562m, 467m, 452s, 438s (SO$_4$ bending), 337m, 318s, 222vs, 147vs, 121vs, 101vs (Bi–O lattice vibrations.). The IR spectrum shows SO$_4$ stretching modes in the 1000–1200 cm$^{-1}$ and the OH-stretching modes in the 3000–3600 cm$^{-1}$ with no significant bands around 1600 cm$^{-1}$ (expected region for the bending modes of molecular water). Both Raman and IR spectroscopy confirm the presence of OH groups and the absence of molecular water, and OH···O geometry comparable with the structural data. The crystal structure refined to $R_1 = 4.24\%$ in the $P2_1/c$ space group. The cell parameters: $a = 7.7196(5)$ Å, $b = 13.8856(9)$ Å, $c = 5.6980(4)$ Å, $\beta = 109.174(1)$, $D_{\text{calc}} = 6.494$ g/cm$^3$ with $Z = 4$. The crystal structure consists of anion-centered Bi$_2$O$_4$(OH)$_2$ tetrahedron forming chains running parallel to [001] and strongly bonded along [100] by isolated SO$_4$ tetrahedra. Each BiO$^-$ tetrahedron is further connected along [010] by OH groups, making walls of composition Bi$_2$O$_3$(SO$_4$)OH$_2$ parallel to [010]. These walls, that represent half of the cell content, are tied to each other along [010] by fewer Bi–O–S bridges and weaker OH···O bonds. D.B.

References cited

Magbasite

Magbasite was originally described by Semenov et al. (1965) based on wet chemical analysis of ~0.03 g of material, optical data and X-ray powder diffraction. The locality was not given but later found to be Bayan Obo, Inner Mongolia, China. The mineral was approved by IMA with a chemical formula K$\text{BaAl(Sc)$}$(Mg$^{Fe^{3+}}$)$_2$$\text{Si}_5\text{O}_{20}$Fe$_2$. Yang et al. (2009) analyzed material of Semenov but reported a different chemical formula: K$\text{Ba(Mg,Fe)$_2$Si}_2\text{O}_7$F$_2$ (with no Sc) and an orthorhombic lattice: $a = 22.70(4)$, $b = 19.01(4)$, $c = 5.28(2)$ Å. Lately, a mineral phase close to magbasite in composition was discovered at the Eldor
carbonatite complex, Québec, Canada. The mineral was found in thin veins cutting ferro dolomite- and siderite-carbonatites in association with phlogopite, quartz, siderite, Nb-rich rutile, bafertisite, monazite-(Ce), rare-earth fluoro-carbonates (bastnasite-parisite), and fluorite. Magbasite occurs as aggregates of lavender sub-parallel to acicular crystals. It is biaxial negative with α = 1.597(1), β = 1.612(1), γ = 1.618(1), 2V = 65(5)°, and 2V ∞ = 64.1°; X = a, Y = b, and Z = c; dispersion of optical axes is moderate r > v. The mineral is pleochroic Z (lavender) > Y (colorless). The averaged electron probe analyses (EDS, 12 points on several grains) gives [wt% (range)]: K₂O 3.62 (3.51–3.90), BaO 13.96 (13.70–14.13), MgO 23.33 (22.96–23.85), MnO 0.54 (0.46–0.64), total Fe as Fe₂O₃ 10.22 (8.13–11.92) (FeO 3.42, Fe₂O₃ 6.62), Al₂O₃ 0.88 (0.30–1.61), SiO₂ 42.32 (42.01–42.58), F 9.81 (9.54–10.07), H₂O 1.74, −O–F 4.13, total 101.91 wt% (FeO²⁺/Fe³⁺ ratio and H₂O are calculated from crystal structure refinement). The empirical formula of magbasite calculated on the basis of 30 (O+F) anions is K₂Ba₁₋₂Mg二人Fe³⁺₂Al₃Si₇O₂₅(OH)₁.1F₅.75. Single-crystal Raman microspectroscopy at a room temperature identified a pair of strong peaks at 3630/3636 cm⁻¹ (OH-vibrations) and a pair of very weak peaks at 3719/3735 cm⁻¹ assigned to a small amount of OH in the amphibole-like chain of octahedra substituting for F. Powder infrared spectroscopy identified peaks at ~3620, ~3630, ~3640, and ~3653 cm⁻¹. The strongest lines of the X-ray powder diffraction pattern are [d_obs Å (I_{rel}%, hkl)]: 3.546 (47; 241,401), 2.991 (68; 441), 2.572 (100; 461,202), 2.416 (41; 312,606), 2.306 (38; 042,332,402,731). The crystal structure of magbasite was solved by direct methods and refined to R₁ = 2.6%. The mineral is orthorhombic, Cmme, a = 18.9506(3), b = 22.5045(3), c = 5.2780(1) Å, V = 2250.93 Å³, and Z = 2. The crystal structure of magbasite is related to both carpholite and amphibole topologies. An amphibole-like chain (I-beam) parallel to [100] of edge-sharing M octahedra occupied by Mg is sandwiched in-between double-chains of SiO₄ tetrahedra parallel to the c axis. The I-beam is linked to the side ribbons of edge-sharing octahedra occupied by Mg, Fe³⁺, and Fe²⁺, and the linkage forms a tunnelled or trellis structure similar to that of carpholite. K occupies a twin site analogous to the A site of amphibole, while Ba occupies a cavity site at the intersection of the I-beam and side-ribbon, and corresponds to the A site of carpholite.

**References cited**


**SINNERITE**


Sinnerite, a rare sulfosalt from the famous Lengenbach quarry, Binn Valley, Canton Valais, Switzerland, was originally described as mineral with complicated superlattice structure with a small subcell a = 3.72, b = 3.70, c = 5.24 Å, α = β = γ = 90° (Marumo and Nowacki 1964). Later Makovicky and Skinner (1975) use a synthetic specimen to show the triclinic symmetry of sinnerite (despite of presence sphalerite-like substructure with a ~ 5.25 Å) with cell parameters a = 9.064, b = 9.830, c = 9.078 Å, α = 90.00, β = 109.30, γ = 107.48°. Z = 2, space group P1 and propose a structural model. Both natural and synthetic crystals were complexly twinned with twins containing 24 individuals and simulate a 3m cubic symmetry. The twinning resulted in high R value (17.2%) and large errors in the atom coordinates and the bond distances. In this study the crystal structure was solved on a natural gem-quality, untwinned sinnerite crystal from the type locality. Cu₆As₁₂S₁₉ stoichiometry was confirmed by semi-qualitative SEM-EDS analysis. The mineral is structurally identical to synthetic Cu₆As₁₂S₁₉. The triclinic symmetry with space group P1 was confirmed with a = 9.103(2), b = 9.860(3), c = 9.111(2) Å, α = 90.27(2), β = 109.53(2), γ = 107.58(2)°, V = 729.6 Å³, and Z = 2. The crystal structure of sinnerite has been refined on a homogeneous crystal fragment (100×115×130 μm) to R₁ = 5.45% for 1028 unique reflections with I > 2σ(I). The structure of sinnerite contains 8 different AsS₄ coordination pyramids and 12 distinct CuS₆ coordination tetrahedra. There are 18 distinct S positions in these polyhedra. It consists of a sphalerite substructure with 2/5 of the tetrahedra replaced by AsS₄ pyramids; 4 pyramids form AsS₁₂ clusters. The true-cell reflections resulted mostly from the presence of sulfur vacancies in the centers of 2 crystallographically independent AsS₁₂₅ clusters and from the deviation of As sites from the regular tetrahedral arrangement. Alternatively the structure can be described in terms of AsS₄ pyramids linked into twisted and branched chain-like structures with compositions AsS₁₂ and AsS₁₁. The chains are linked by CuS₆ tetrahedra. Packing of these chains results in the OD (order-disorder) character of the sinnerite structure.

**References cited**
