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New Mineral Names*

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ANORPIMENT*

A.R. Kampf, R.T. Downs, R.M. Housley, R.A. Jenkins, and J. Hyršl (2011) Anorpiment, As_2S_3, the triclinic dimorph of orpiment. Mineralogical Magazine, 75(6), 2857–2867.

Anorpiment, ideally As_2S_3, is the triclinic dimorph of orpiment. It occurs at the Palomo mine, Castrovirreyna Province, Huancavelica Department, Peru. The Palomo mine belongs metallogenetically to the Huachocolpa ore district. The rocks in the area of the mine are exclusively volcanic, comprising andesitic lavas, pyroclastic rocks, tuffs, and breccias. All of the mineralized veins are found within these rocks. An intrusive diorite stock has been identified at depth and it is believed to be responsible for the mineralization. Anorpiment is a low-temperature hydrothermal mineral associated with dufrénoysite, muscovite, orpiment, pyrite, and realgar. It occurs in drusy crusts of wedge-shaped, transparent, greenish-yellow crystals up to 0.2 mm in their maximum dimension. The crystals are typically oriented with their (001) faces approximately parallel to the surface on which the druse is growing. The streak is yellow. The luster is resinous on crystal faces, but pearly on cleavage surfaces. The Mohs hardness is about $1\text{-}^1/_2$. The mineral is sectile with an irregular fracture and one perfect and easy cleavage on {001}. The measured and calculated densities are 3.33 and 3.321 g/cm^3, respectively. All refraction indices are greater than 2. Optically, the mineral is biaxial negative, with $2V = 35–40°$; no optical dispersion is observed. The acute bisectrix (X) is approximately perpendicular to the {001} cleavage.

Electron microprobe analyses (in wavelength-dispersive mode), yielded the average composition (in wt%): As 58.21, S 38.72, total 96.94, providing the following empirical formula (based on 5 atoms) $As_{1.96}S_{3.04}$. The low total is attributed to the fine-scale porosity of the sample. The seven strongest observed X-ray powder diffraction lines are [d in Å (I_{obs} %; hkl)]: 4.867(97; 002), 4.519(77;110,$11\bar{1}$), 3.702(46;$\bar{1}\bar{1}1$), 3.609(82;022,$1\bar{1}2$), 2.880(75;201,$0\bar{2}2$,$\bar{1}\bar{2}1$,023), 2.552(100;$\bar{1}13$,$\bar{1}31$,132), 2.469 (96;114,130,$1\bar{3}1$). Unit-cell parameters refined from the X-ray powder diffraction data with whole pattern fitting are: a = 5.755(3) Å, b = 8.724(3) Å, c = 10.280(3) Å, α = 78.129(8)°, β = 75.724(10)°, γ = 89.913(7)°, and V = 488.8(3) Å^3 (Z = 4).

The crystal structure of anorpiment was refined on the basis of single-crystal X-ray diffraction data in the space group $P\bar{1}$, and refined to $R_1 = 0.021$ for 1484 reflections with $F_o > 4\sigma(F_o)$. The structure consists of layers of covalently bonded As and S atoms. Each S atom bonds to two As atoms at As-S-As angles between 100.45 and 104.15°. Each As atom is strongly bonded to three S atoms at S-As-S angles between 91.28 and 103.59°, forming an AsS_3 pyramid with As at its apex. The As-S linkages within the layers form rings of six AsS_3 pyramids. Interlayer bonding forces are interpreted as van der Waals. The structure of anorpiment is similar to that of orpiment in that it is composed of layers of As_2S_3 macromolecules, but arranged in a different stacking sequence.

The new mineral and name have been approved by the Commission on New Minerals, Nomenclature and Classification of the International Mineralogical Association (IMA 2011-014). Two co-type specimens are deposited in the Natural History Museum of Los Angeles County, catalog numbers 63514 and 63544. One cotype is deposited in the collections of the Mineral Museum of the University of Arizona, catalog number 19326. **G.D.G. and F.C.**

COSSAITE*

F. Demartin, C.M. Gramaccioli, I. Campostrini, and C. Castellano (2011) Cossaite, $(Mg_{0.5},\square)Al_6(SO_4)_6(HSO_4)F_6\cdot36H_2O$, a new mineral from La Fossa crater, Vulcano, Aeolian Islands, Italy. Mineralogical Magazine, 75(6), 2847–2855.

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* All minerals marked with an asterisk have been approved by the IMA CNMMC. E-mail: ktait@rom.on.ca

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Cossaite (IMA 2009-031), ideally $(Mg_{0.5},\square)Al_6(SO_4)_6(HSO_4)F_6{\cdot}36H_2O$ is a new mineral found in the altered pyroclastic breccia of an active fumarole (*T* about 350 °C) located at the rim of the La Fossa crater, Vulcano, Aeolian Islands, Sicily, Italy, where it is found associated with thermessaite, vlodavetsite, sassolite, and salammoniac. The mineral name honors Alfonso Cossa (1833–1902), an Italian chemist and mineralogist who was the author of several publications about the minerals of Vulcano, including descriptions of new species such as hieratite. The crystals (up to 100 μm in size) are stout prismatic in habit and terminated by rhombohedral faces. They are colorless, the streak is white, and the luster vitreous. No fluorescence was observed under either short-wave or long-wave ultraviolet radiation. The tenacity is brittle and the fracture is uneven. The calculated density is 2.075 g/cm^3. Mean refractive index n_{obs} is 1.49(1) (589 nm; measured by immersion methods in a kerosene-monochloronaphthalene mixture). Electron microprobe analyses (in energy-dispersive mode), yielded the average composition (in wt%): MgO 1.4, Al_2O_3 19.5, SO_3 34.7, F 5.7, (H_2O 40.85, from structure refinement), O=F –2.4, total 99.75 wt%, corresponding to the empirical formula $Mg_{0.56}Al_{6.19}S_{7.01}H_{73.37}F_{4.85}O_{65.15}$ calculated on the basis of 70 oxygen plus fluorine atoms. The six strongest observed X-ray powder diffraction lines are [*d* in Å (I_{obs} %) (*hkl*)]: 4.15 (100) (140), 3.87 (70) ($3\bar{2}2$), 11.00 (50) (110), 4.58 (25) (131), 2.770 (20) ($\bar{3}33$), 2.166 (20) ($\bar{1}\bar{8}1$). Unit-cell parameters, refined from the X-ray powder diffraction data (Gandolfi camera 114.6 mm Ø) by full-profile fit, are a = 22.002(3), c = 9.232(2) Å, V = 3870.5(9) Å^3 (Z = 3). The crystal structure of cossaite was solved by direct methods on the basis of single-crystal X-ray diffraction data (Bruker Apex II CCD diffractometer with Mo*K*α radiation) in the space group $R\bar{3}$ [a = 22.010(2), c = 9.238(1) Å, V = 3875.6(6) Å^3, D_{calc} = 2.075 g/cm^3, and refined to R_1 = 3.49% for 1926 reflections with $Fo > 4\sigma(Fo)$]. The crystal structure of cossaite contains octahedral $[Al(H_2O)_5F]^{2+}$-groups and sulphate anions interacting via hydrogen bonds to form channels running along [001], where disordered $[Mg(H_2O)_6]^{2+}$-groups and hydrogensulphate anions are hosted. Cossaite is a rare example of a mineral containing the hydrogensulphate ion. Other minerals that contain this group include mercallite [$KHSO_4$], matteuccite [$NaHSO_4{\cdot}H_2O$], letovicite [$(NH_4)_3H(SO_4)_2$], and probably misenite [$K_8(HSO_4)_6SO_4$]. The holotype specimen (no. 2009-1) is deposited in the Reference Collection of the Dipartimento di Chimica Strutturale e Stereochimica Inorganica at the Università degli Studi di Milano. The name cossaite was used previously for a potassium-bearing variety of paragonite found at Fenestrella near Borgofranco, Valle del Chisone, Torino, Italy (Schaller and Stevens 1941); this is not a valid mineral species. **F.C. and G.D.G.**

REFERENCES CITED

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FASSINAITE*

L. Bindi, F. Nestola, U. Kolitsch, A. Guastoni, and F. Zorzi (2011) Fassinaite, $Pb^{2+}_2(S_2O_3)(CO_3)$, the first mineral with coexisting thiosulphate and carbonate groups: description and crystal structure. Mineralogical Magazine, 75(6), 2721–2732.

Fassinaite (IMA 2011-048), ideally $Pb^{2+}_2(S_2O_3)(CO_3)$, is a new mineral from the Trentini mine, Mount Naro, Vicenza Province, Veneto, Italy (holotype locality). Fassinaite is named after Bruno Fassina (b. 1943), an Italian mineral collector who discovered the mineral at the type locality in 2009. The mineral is also reported from the Erasmus adit, Schwarzleo District, Leogang, Salzburg, Austria, and the Friedrich-Christian mine, Schapbach, Black Forest, Baden-Württemberg, Germany (co-type localities). At the Trentini mine (Veneto, Italy), the mineralization is linked to Mid-Triassic calc-alkaline magmatism, where hydrothermal fluids deposited sulfides, barite, and Fe- and Mn-bearing minerals at the boundary between volcanites and limestone. The fassinaite is found as radiating aggregates of acicular, colorless crystals up to 200 μm long, closely associated with galena, quartz, and anglesite. At the Erasmus adit (Salzburg, Austria), where polymetallic primary Ag, Pb, Zn, Cu, Ni, Co, Hg, As, and Sb ores were exposed to low-grade metamorphism, fassinaite is found as sprays of colorless, prismatic crystals, up to 0.4 mm long, in fractures in massive galena, on cerussite, and anglesite. The Austrian material was collected by Rolf Poeverlein (Traunstein, Germany) from a small dump of probably middle age, which consists of cobbed sulfide ore; additional much rarer specimens (not considered to be cotype material) were found on a dump from the Herren adit (Schwarzleo District). At the Friedrich-Christian mine (Baden-Württemberg, Germany), fassinaite is found as small sprays of prismatic crystals (<0.2 μm) in hydrothermal veins containing Pb-Zn ores. In Austrian specimens, where crystals are sufficiently well developed, the prism {101} is large and dominant, with a flat chisel-shaped {*hk*0} termination; additional possibly {011} form is also rarely present. No twinning has been observed. Fassinaite is transparent with a vitreous to adamantine luster and a white streak. It is brittle with an irregular fracture and non-discernible cleavage. The Mohs hardness is estimated to be 1½–2. The mineral is not fluorescent. The calculated density is 6.084 g/cm^3. Fassinaite has intense internal reflections, which hamper reflectance measurements. Crystals are length-slow and have very high birefringence. Mean calculated refractive index n_{cal} is 2.13. Electron microprobe analyses (in wavelength-dispersive mode), yielded the average composition (in wt%): PbO 77.1(4), SO_3 12.0(1), S^{2-} 4.83(1) [CO_2 7.60(4) calculated for every analysis by stoichiometry], O = S^{2-} –2.41(2), total 99.2, corresponding to the empirical formula $Pb_{2.01(1)}(S_{1.82(2)}O_3)CO_3$ (on the basis of six oxygen atoms). The presence of both carbonate and thiosulphate groups was validated by Raman spectra. The simplified formula (S content partitioned into S^{6+} and S^{2-} in a 1:1 ratio on the basis of structural considerations) is $Pb^{2+}_2(S^{6+}S^{2-}O_3)(CO_3)$, which requires PbO 76.11, SO 16.39, CO_2 7.50, total 100.00 wt% (sulphur expressed as SO). The eight strongest observed X-ray powder diffraction lines calculated from the structure model are [*d* in Å (I_{obs} %) (*hkl*)]: 4.410 (39) (101), 4.381 (59) (020), 4.080 (62) (400), 3.504 (75) (301), 3.108 (100) (121), 2.986 (82) (420), 2.952 (49) (221) and 2.736 (60) (321). The crystal structure of fassinaite was solved by a three-dimensional Patterson synthesis on the basis of single-crystal X-ray diffraction data (STOE-STADI IV CCD single-crystal diffractometer with Mo*K*α radiation) in the space group *Pnma* with unit-cell parameters (for the holotype material) a = 16.320(2), b = 8.7616(6),

c = 4.5809(7) Å, V = 655.0(1) Å^3, a:b:c = 1.863:1:0.523, Z = 4. Structure refinements, done on diffraction data obtained from crystals coming from the three localities, yielded R_1 values ranging from 3.53–5.96%. The structure of fassinaite consists of rod-like arrangements of Pb-centered polyhedral that extend along the [010] direction. These "rods" are linked, alternately, by $(CO_3)^{2-}$ and $(S_2O_3)^{2-}$ groups. The $(S_2O_3)^{2-}$ groups point alternately left and right (in a projection on [001] with [010] set vertical) if the apex occupied by the S^{2-} in the thiosulphate group is defined to be the atom giving the direction. The lead atoms are nine-coordinated by seven oxygen atoms and two sulphur (S^{2-}) atoms. Observed Raman bands are (in cm^{-1}, s = strong, w = weak, v = very, sh = shoulder): 75, 118, 180, 203, 250, 348, 358, 438(s), 520, 549, 602, 629(sh), 637(vs), 722(vw), 845(w), 983(w to s), 1061(s), 1081(w), 1137(vw), 1322(vw), 1444(vw), 1690 (vw). Fassinaite forms as a result of the supergene alteration of galena: likely that thiosulphate formation occurred at an intermediate stage in the oxidation process as the assemblages moved toward complete oxidation. Holotype specimen from the Trentini mine (MMP M10008) is deposited in the mineral collection of the Museum of Mineralogy of the Department of Geosciences at the University of Padova, Italy. Co-type specimens from Salzburg and the Black Forest are deposited in the mineral collection of the Naturhistorisches Museum of Wien, under catalog numbers N 9055 (four micro-mounts and one crystal used for structure determination) and N 9056 (crystal used for structure determination; the micro-mount-sized specimen from the Black Forest is in the collection of Stephan Wolfsried, Waiblingen, Germany), respectively. **F.C. and G.D.G.**

LAMMERITE-β*

G.L. Starova, L.P. Vergasova, S.*K*. Filatov, S.N. Britvin, and V.V. Ananyev (2011) Lammerite-β, $Cu_3(AsO_4)_2$—a new mineral from fumaroles of the Great fissure Tolbachic eruption (Kamchatka, Russia). Zap. Ross. Mineral. Obshch., 140(5), 46–51 (in Russian, English abstract).

A new polymorph of $Cu_3(AsO_4)_2$–lammerite-β was discovered among the products of post-eruption fumarolic activity at the Second Scoria cone of the Northern Branch of the Great fissure Tolbachik eruption (1975–1976), Kamchatka peninsula, Russia. It was formed at temperature 400–650 °C in close association with euchlorine, piypite, alumokluchevskite, alarsite, and lammerite. The mineral is light to dark green and vitreous. It occurs as rare irregular shape euhedral grains of prismatic habit (up to 0.15 mm in size), which have striations parallel to elongation. Fine hematite inclusions produce brownish spots or decorating lammerite-β growth zones. Cleavage was not observed. Mineral is brittle, Mohs hardness and measured density are not given. D_{calc}= 5.06 g/cm^3. It does not fluoresce under UV light. Lammerite-β is optically biaxial positive, α = 1.887(5), β = 1.936(5), γ = 2.01(1), $2V_{calc}$ = 81°; dispersion of optical axes r < v, strong. No pleochroism observed. The average (range) of 5 microprobe analyses (wt%) are: CuO 51.30 (50.86–52.12), ZnO 0.32 (0.20–0.52), As_2O_3 49.12 (48.59–50.62), total 100.74. The empirical formula based on 8O is $Cu_{3.00}Zn_{0.02}As_{1.99}O_8$, the idealized formula is $Cu_3(AsO_4)_2$. Powder X-ray data were obtained using powder diffractometer DRON-3.0 (filtered Cu$K\alpha_1$ radiation). The strongest lines on the diffraction pattern [d_{obs} in Å (I_{obs}%, hkl)] include: 6.50 (10, 011), 5.65 (10, 002), 4.32 (10, 020), 4.03 (5, 021), 2.90 (5, 211), 2.86 (5, 023), 2.83 (100, 004). They are in accordance with those for synthetic β-$Cu_3(AsO_4)_2$. Single-crystal X-ray data were collected using difractometer BRUKER SMART CCD (Mo$K\alpha$ radiation). The crystal structure was solved by direct methods and refined to R = 0.038 based on 2114 unique reflections with $I > 4\sigma$. The unit-cell parameters are: a = 6.306(1), b = 8.643(1), c = 11.310(1) Å, β = 92.26 (1)°, V = 615.9(1) Å^3, space group $P2_1/c$, and Z = 4. In the structure of lammerite-β, three differently coordinated Cu-polyhedra Cu1(5), Cu2(5), Cu3(6) form 6-membered rings by sharing vertexes or edges. Those rings form layers parallel to (101), which are doubled by joining through polyhedra Cu3 and As-tetrahedra. Those corrugated double layers are connected by As-tetrahedra into three-dimentional construction. The name shows the mineral is monoclinic polymorph of lammerite. Both the mineral and the name have been approved by the IMA CNMNC (IMA 2009-002). Type specimen deposited in the Mineralogical Museum of the Saint Petersburg University, Saint Petersburg, Russia. **D.B.**

LILEYITE*

N.V. Chukanov, I.V. Pekov, R.K. Rastsvetaeva, S.M. Aksenov, A.E. Zadov, K.V. Van, G. Blass, W. Shüller, and B. Ternes (2012) Lileyite, $Ba_2(Na,Fe,Ca)_3MgTi_2(Si_2O_7)_2O_2F_2$, a new lamprophyllite-group mineral from the Eifel volcanic area, Germany. European Journal of Mineralogy, 24, 181–188.

Lileyite (IMA 2011-021) is a member of the lamprophyllite group, an analogue of barytolamprophyllite-2M with Mg predominant in M3 site and F predominant in X site. It was discovered at the Löhley quarry, Üdersdorf, near Daun, Eifel Mountains, Rhineland-Palatinate (Rheinland-Pfalz), Germany, and named for the old name of the type locality, Liley. Associated minerals are nepheline, leucite, augite, magnetite, fluorapatite, perovskite, and götzenite.

Lileyite is brown, translucent; streak is white. It forms platy crystals up to 0.1 × 0.3 × 0.5 mm in size and their clusters up to 1 mm across on the walls of cavities in an alkaline basalt. The main crystal form is {100}. Lileyite is optically biaxial (+), α = 1.718(5), β = 1.735(5), γ = 1.755(5), $2V$ = 75(15)°, $2V_{calc}$ = 86°. Dispersion is medium, $r > v$. Orientation: $X = a$; Y coincides with the elongation direction of crystals. Pleochroism is medium, Z (grayish-brown) > Y (light brown) > X (colorless).

The IR spectrum is given. The chemical composition is (EDS-mode electron microprobe, mean of five analyses, wt%): SiO_2 28.05, BaO 26.39, TiO_2 18.53, Na_2O 6.75, MgO 4.58, FeO 4.48, CaO 2.30, SrO 2.23, MnO 1.44, K_2O 1.41, Nb_2O_5 0.95, F 3.88, –O=F_2 –1.63; total 99.36. The empirical formula based on 18 anions is: $Ba_{1.50}Sr_{0.19}K_{0.26}Na_{1.89}Ca_{0.36}Mn_{0.18}Mg_{0.99}Fe_{0.54}Ti_{2.01}Nb_{0.06}Si_{4.06}O_{16.23}F_{1.77}$. The simplified formula is: $Ba_2(Na,Fe,Ca)_3MgTi_2(Si_2O_7)_2O_2F_2$. The crystal structure was solved using single-crystal X-ray diffraction data (R = 0.024). Lileyite is monoclinic, space group $C2/m$, a = 19.905(1), b = 7.098(1), c = 5.405(1) Å, β = 96.349(5)°, V = 758.93(6) Å^3, and Z = 2. The strongest lines of the powder diffraction pattern [d_{obs} in Å (I_{obs}, hkl)] are: 3.749 (45,$31\overline{1}$), 3.464 (76,510,311,401), 3.045

$(37,51\bar{1})$, 2.792 (100,221,511), 2.672 $(54,002,601,20\bar{2})$, 2.624 $(43,710,42\bar{1})$.

The type material is deposited in the collection of the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia, and registration number 4106/1. **K.T.T.**

MEGAWITE*

E.V. Galuskin, I.O. Galuskina, V.M. Gazeev, P. Dzierżanowski, K. Prusik, N.N. Pertsev, A.E. Zadov, R. Bailau, and A.G. Gurbanov (2011) Megawite, $CaSnO_3$: a new perovskite-group mineral from skarns of the Upper Chegem caldera, Kabardino-Balkaria, Northern Caucasus, Russia. Mineralogical Magazine, 75(5), 2563–2572.

Megawite, ideally $CaSnO_3$, is a perovskite-group mineral discovered in altered silicate-carbonate xenoliths in the Upper Chegem caldera, Kabardino-Balkaria, Northern Caucasus, Russia. Megawite occurs in ignimbrite, where it forms by contact metamorphism at a temperature >800 °C and low pressure, and occurs associated with spurrite, reinhardbraunsite, rondorfite, wadalite, srebrodolskite, lakargiite, perovskite, kerimasite, elbrusite–(Zr), periclase, hydroxylellestadite, hydrogrossular, ettringite-group minerals, afwillite, hydrocalumite, and brucite. Megawite is Zr-rich and usually crystallizes on lakargiite, $CaZrO_3$. Orthorhombic perovskites of the $CaTiO_3$–$CaZrO_3$–$CaSnO_3$ system are widespread in skarns that have formed within xenoliths in the ignimbrites of the Upper Chegem caldera. Homogeneous megawite ($CaSnO_3$ ~56 mol%, $CaZrO_3$ ~34 mol%) and lakargiite ($CaZrO_3$ ~67 mol%, $CaSnO_3$ ~27 mol%) crystals are commonly found, and usually occur as inclusions in spurrite crystals. The megawite holotype reaches $CaSnO_3$ ~61 mol% (by electron microprobe analysis in wavelength-dispersive mode), and so contains substantial amounts of $CaTiO_3$ and $CaZrO_3$ in solid solution.

Megawite is found in small crystals (<15 μm) with pseudo-cubic and pseudo-cuboctahedral habits, with a good cleavage along (110) and (001) (orthorhombic indices). Crystals are transparent and pale yellow or colorless with a vitreous luster and white streak. Megawite is biaxial, but twinning and small crystal sizes prevented the determination of the refractive indices and optic sign. The calculated refractive index of megawite is 1.89 (for pure $CaSnO_3$). The synthetic analogue of megawite, orthorhombic $CaSnO_3$, is optically positive. Crystallographic orientation, by analogy with lakargiite, is: $X = \beta$, $Y = \alpha$, $Z = \gamma$.

Due to the scarcity of megawite and the small size of the available crystals, a powder X-ray diffraction pattern could not be collected. The unit-cell parameters and space group of the synthetic counterpart of megawite ($CaSn_{0.6}Zr_{0.4}O_3$), derived from electron back scattered diffraction, are: a = 5.555(3), b = 5.708(2), c = 7.939(5) Å, V = 251.8(1) Å^3, *Pbnm*, and Z = 4, calculated density of 5.06 g/cm^3. The five strongest calculated X-ray powder diffraction lines are [d in Å (I_{calc} %, hkl)]: 2.812(100,112), 3.984(52,110), 2.855(43,020), 3.970(19,002), 2.780(19,220).

The name megawite honors the British crystallographer Helen Dick Megaw (1907–2002). Holotype samples of megawite are deposited in the Mineralogical Museum of Wrocław University, Poland, under accession number MMUWr II16 717 and in the Fersman Mineralogical Museum, Moscow, Russia, under accession number 4021/1. **G.D.G. and F.C.**

PERRIERITE-(LA)*

N.V. Chukanov, G. Blass, I.V. Pekov, D.I. Belakovskiy, K.V. Van, R.K. Rastsvetaeva, and S.M. Aksenov, (2011) Perrierite-(La) $(La,Ce,Ca)_4Fe^{2+}(Ti, Fe)_4(Si_2O_7)_2O_8$—a new mineral species from volcanic region Eifel, Germany. Zap. Ross. Mineral. Obshch., 140(6), 34–44 (in Russian, English abstract).

A new chevkinite-group member perrierite-(La) has been found in pumice quarry In den Dellen near Mendig, Laacher See area, Eifel Mts., Rhineland-Palatinate (Rheinland-Pfalz), Germany. The mineral found in miarolitic cavities in sanidinite lava in association with sanidine, phlogopite, pyrophanite, zirconoiite, jakobsite, magnetite, fluorocalciopyrochlore, and zircon. Perrierite-(La) occurs as isolated prismatic crystals up to 0.5 × 1 mm in size. Crystals are columnar along [010] or flattened by (001). The mineral is black with a brown streak and strong vitreous luster. It is brittle, with Mohs hardness of 4, has distinct cleavage on (001) and conchoidal fracture. Density was not measured, D_{calc} = 4.791 g/cm^3. IR spectrum is similar to chevkinite-(Ce). IR absorption bands (cm^{-1}, s = strong, w = weak, sh = shoulder) are 1038s, 925s, 885sh (Si-O stretching vibrations), 800sh, 625sh, 624, 575 (stretching vibrations of Ti-O and Si_2O_7 groups), 499s, 465sh, 395 [bending vibrations of Si-O and stretching vibrations of $(Fe,Mn)O_6$ octahedra]. No absorbtion bands related to H-, B-, or C-containing groups were observed. Perrierite-(La) is biaxial negative, α =1.94(1), β = 2.020(15), γ = 2.040(15) (λ = 589 nm), $2V$ = 50(10)°, $2V_{calc}$ = 51°. The average (range) of seven analyses performed by EDS (the ratio Fe^{2+}/Fe^{3+} determined from structural data) gave: CaO 3.26 (3.09–3.52), La_2O_3 22.92 (22.18–23.50), Ce_2O_3 19.64 (19.08–20.25), Pr_2O_3 0.83 (0.40–1.56), Nd_2O_3 2.09 (1.86–2.27), MgO 0.25 (0–0.47), MnO 2.25 (1.97–2.65), FeO 3.16, Fe_2O_3 5.28 [7.65–8.16 total Fe as FeO], $A1_2O_3$ 2.59 (2.05–2.93), TiO_2 16.13 (15.52–16.90), Nb_2O_5 0.75 (0.51–0.97), SiO_2 20.06 (19.55–20.42), total 99.21 wt%. The empirical formula is $(La_{1,70}Ce_{1.45}Nd_{0.15}Pr_{0.06}Ca_{0.70})_{\Sigma 4.06}(Fe^{2+}_{0.53}Mn_{0.38}Mg_{0.08})_{\Sigma 0.99}(Ti_{2.44}Fe^{3+}_{0.80}Al_{0.62}Nb_{0.07})_{\Sigma 3.93}Si_{4.04}O_{22}$. The idealized formula is $(La, Ce, Ca)_4Fe^{2+}(Ti,Fe)_4(Si_2O_7)_2O_8$. Powder X-ray diffraction data were obtained using a Stoe IPDS II single-crystal diffractometer (Mo*K*α radiation). The strongest lines on the diffraction pattern [d_{obs} (Å) (I_{obs}%, hkl)] are: 5.19 (40, 110), 4.07 (20, $\bar{1}12$), 3.53 (40, $\bar{3}11$), 2.96 (100, $\bar{3}13$, 311), 2.80 (50, 020), 2.14 (50, 422, 315, 313), 1.947 (50, 024, 223), 1.657 (40, 407, 333, 331). The unit-cell parameters refined from powder X-ray data are: a = 13.67(5), b = 5.658(9), c = 11.70(4) Å, β = 113.8(2); V = 832.2(2) Å^3. Single-crystal X-ray data were collected using difractometer Xcalibur Oxford Diffraction with CCD detector (Mo*K*α radiation). Perrierite-(La) is monoclinic, space group $P2_1/a$; unit-cell parameters are: a =13.668(1), b = 5.6601(6), c = 11.743(1) Å, β = 113.64(1)°; V = 832.2(2) Å^3, and Z = 2. The structure (refined to R = 0.0421) is identical to its synthetic analogue. The layers of distorted Ti-octahedra M2 and M3 alternate with heteropolyhedric layers where each of diorthogroups Si_2O_7 connected through the vertexes to six $(Fe,Mn)O_6$ octahedra. Both cation positions in the channels between the layers have coordination of 9 and populated by REE. One of them contain Ca besides REE. The crystallo-chemical formula of perrierite-(La) suggested as: $^{IX}REE_2{}^{IX}(REE,Ca)_2{}^{VI}(Fe^{2+},Mn)^{VI}Ti_2{}^{VI}(Ti,Fe,Al)_2(Si_2O_7)_2O_8$. The name "Perrierite-(La)" was used before for the mineral from Bjorkedalen, near Oslo, Norway (Segalstad and Larsen 1978). Finds of La enriched or dominant minerals of similar composition were also reported from Virginia, U.S.A., and Khibiny, Russia. However all those were metamict and there was no proof whether the protophases belong to perrierite or to chevkinite structure subtype. So the name was not approved. The mineral from Eifel is originally crystalline. The position of perrierite-(La) in chevkinite group and comparative data for other minerals of the group are discussed in details as well as possible ways of La concentration in perrierite. The name perrierite-La (as for La dominant member of perrierite structure type) for this mineral has been approved by the IMA CNMNC as well as species itself (IMA 2010-089). Type specimen is deposited in the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. **D.B.**

REFERENCES CITED

Segalstad, T.V. and Larsen, A.O. (1978) Chevkinite and perrierite from the Oslo region, Norway. American Mineralogist, 63, 499–505.

UNNAMED MINERALS†

Unnamed calcium chromate dihydrate: UM2011-01-CrO:CaH

E.V. Sokol, O.L. Gaskova, S.N. Kokh, O.A. Kozmenko, Y.V. Seryotkin, Y. Vapnik, and M.N. Murashko (2011) Chromatite and its Cr^{3+}- and Cr^{6+}-bearing precursor minerals from the Nabi Musa Mottled Zone complex, Judean Desert. Amer. Mineral., 96, 659–674.

The mineral occurs in the Mottled Zone (Hatrurim Formation) at the Naba Musa locality, Judean Desert, Israel, where it may have formed when gradual heating of air and rocks caused the precipitation of chromatite and calcium chromate dihydrate by direct capillary evaporation. The mineral occurs as flattened, "flake-like" grains with uneven margins. Only one analysis is available and that, with water calculated by difference, gives (wt%): CaO 29.30, CrO_3 48.17, SO_3 1.85, H_2O 20.68, total 100%, or, on the basis of (Cr+S) = 1, an empirical formula: $Ca_{1.035}(Cr^{6+}_{0.954}S^{6+}_{0.046})_{\Sigma 1.000}O_{4.035}\cdot 2.273H_2O$, i.e., close to $CaCrO_4\cdot 2H_2O$. No additional information was reported. **D.G.W.S.**

Unnamed lunar minerals: UM2011-02-O:CaCeGdLaTiUZr, UM2011-03-O:CaKUV, and UM2011-04-O:LaMnSrTi

A.V. Mokhov, P.M. Kartashov, T.A. Gornostaeva, O.A. Bogatikov, and N.A. Ashikhmina (2011) New phases of lanthanoids and actinoids from the regolith samples delivered by the *Luna*-24. Doklady Earth Sciences, 437, Part 2, 479–482 (in English). Doklady Akademii Nauk, 437, No. 4, 536–539 (in Russian).

Three unnamed minerals are reported from the lunar regolith of Mare Crisium—none has a terrestrial analogue.

The first of these minerals (UM2011-02-O:CaCeGdLaTiUZr) occurs as a single particle of ~1 μm size and is considered to be a complex oxide with $A_4B_1Ti_2O_{12}$ stoichiometry and unusual enrichment in Gd. Best estimate of composition gave TiO_2 15.06 ± 0.67, ZrO_2 13.56 ± 1.12, UO_2 1.38 ± 0.51, La_2O_3 1.99 ± 0.90, Ce_2O_3 10.20 ± 0.61, Gd_2O_3 56.50 ± 1.31, CaO 1.31 ± 0.23, (all in wt%), resulting in the empirical formula: $[(Gd_{3.06}Ce_{0.61}La_{0.12})(Ca_{0.23}U_{0.05})]_{\Sigma 4.07}Zr_{1.08}Ti_{1.85}O_{11.88}$, simplified to $(Gd,Ce,Ca,La,U)_4ZrTi_2O_{12}$. No other information is reported. The authors observe that a compound of such composition was previously known "neither in nature nor in technology."

The second mineral, UM2011-03-O:CaKUV, was found as an inclusion of ~15 μm size in a fractured pyroxene grain said to be in the hypersthene compositional range. The composition obtained (in wt%, normalized to 100) was: UO_2 69.82 ± 0.70, Al_2O_3 0.67 ± 0.26, V_2O_3 22.38 ± 0.51, CaO 1.51 ± 0.25, K_2O 5.62 ± 0.42. This corresponds to the formula $K_{2.00}(U_{4.33}Ca_{0.45})_{\Sigma 4.78}(V_{5.00}Al_{0.22})_{\Sigma 5.22}O_{17.94}$, which can be simplified to $K_2(U^{4+},Ca)_5V_5O_{18}$. Again, no other information is reported. The authors draw attention to the anomalous association of K, U, and V in basic rocks and consider that it provides "indirect evidence for hydrothermal activity that significantly spreads the range of the mineral-forming processes on the Moon."

The third mineral, UM2011-04-O:LaMnSrTi, is a complex lanthanum–manganese oxide found as a ~50 μm particle. "Quantitative analysis" gave (wt%): TiO_2 6.16 ± 0.33, La_2O_3 52.53 ± 0.70, SrO 15.98 ± 0.52, MnO 25.33 ± 0.41, total 100%, indicating an empirical formula $(La_{1.42}Sr_{0.68})_{\Sigma 2.10}(Mn_{1.57}Ti_{0.34})_{\Sigma 1.91}O_{5.06}$, and corresponding closely to $A_2B_2O_5$ stoichiometry. The authors point out that the compound $La_2Mn_2O_5$ has not been reported previously either in nature or as a product of synthesis. Again, no other information is reported.

The authors consider these three phases (as well as tranquillityite) to be late-magmatic products of KREEP basalt crystallization. The analytical preparative techniques used appear to be very esoteric and were followed by energy-dispersive analysis in an electron microscope. Thus the reported compositions should perhaps be viewed with some caution. **D.G.W.S.**

Unnamed Tin hydroxide: UM2011-05-OH:FOSn

S.J. Mills, P.M. Kartashov, G.N. Gamyanin, P.S. Whitfield, A. Kern, H. Guerault, A.R. Kampf, and M. Raudsepp (2011) Fluorocronite, the natural analogue of β-PbF2, from the Sakha Republic, Russian Federation. Eur. J. Mineral., 23, 695–700.

A Sn oxy-hydroxide with the composition $Sn_4O(OH,F)_6$, was found intimately mixed with fluorocronite and cassiterite and directly associated with anglesite, bindheimite, cerussite, chlorargyrite, galena, hocartite, and quartz in the Kupol'noe Ag,Sn-deposit, Sarychev range, Sakha Republic. The X-ray

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† For a complete listing of all IMA-validated unnamed minerals and their codes, see: http://pubsites.uws.edu.au/ima-cnmnc/Valid2012.pdf.

powder pattern is distinctive with the 10 strongest lines being (*d*-values, Å, relative intensity): 3.6440 (100), 2.1354 (44), 3.1715 (28), 3.2442 (24), 1.8375 (16), 2.1354 (14), 6.3862 (11), 2.1823 (9), 4.2585 (3). No additional information was reported. **D.G.W.S.**

Unnamed secondary Fe,Al-phosphate: UM2011-06-PO:AlFeHMn

I. Petrík, M. Kubiš, P. Konečný, I. Broska, and P. Malachovský (2011) Rare phosphates from the Surovec topaz—Li-mica microgranite, Gemeric unit, Western Carpathians, Slovak Republic: role of F/H_2O of the melt. Can. Mineral., 49, 521–540.

The mineral was observed in a small body of Permian high-P Li–F microgranite, near Peklisko, Slovakia. It is seen to replace arrojadite. Two wavelength-dispersive electron microprobe analyses gave (wt%): SiO_2 0.64, 0.65; TiO_2 0.10, 0; Al_2O_3 8.09, 16.19; FeO 48.59, 49.61; MnO 5.74, 0; MgO 0.01, 0.33; CaO 0.24, 1.10; Na_2O 0.10, 0; K_2O 0.14, 0.10; SrO 0, 0; BaO 0.12, 0.11; PbO –, 0.53; P_2O_5 18.53, 17.01; F 0.31, 0; Cl 0.01, 0.01 [O=F, O=Cl –0.13, 0] H_2O (by difference) 17.52, 14.35. This gives a mean empirical formula: $(Fe_{2.529}\square_{0.235}Mn_{0.155}Ca_{0.046}Mg_{0.016}K_{0.010}Na_{0.006}Ba_{0.003})_{\Sigma 3.000}$ $Al_{0.912},Fe^{3+}_{0.088})_{\Sigma 1.000}(P_{0.959}Si_{0.041})O_4(OH,H_2O,F)_6$, which can perhaps be simplified to $(Fe,Mn)_3Al(PO_4)(OH)_6$. No information other than compositional is reported. **D.G.W.S.**

Unnamed Ba-analogue of svanbergite and woodhouseite: UM2011-07-POSO:AlBaH

I.A. Izbrodin, G.S. Ripp, and A.G. Doroshkevich (2011) Aluminium phosphate and phosphate-sulphate minerals in kyanite schists of the Ichetuyskoye area, West Transbaikalia, Russia: crystal chemistry and evolution. Mineral. Petrol., 101, 81–96.

The mineral occurs near Ichetuyskoye, Dzhida basin, western Transbaikal region, Russia, as 20–80 μm friable aggregates, micro-veinlets and pseudocubic grains. It is enclosed by natroalunite, woodhouseite, goyazite, and late lazulite as a product of retrograde metamorphism of quartz-muscovite-kyanite schists. Only compositional information is reported and the mean of five microanalyses gave (wt%): F 1.07, Na_2O 0.29, Al_2O_3 31.55, P_2O_5 14.61, SO_3 17.5, K_2O 0.67, CaO 1.01, SrO 0.27, BaO 22.56, Ce_2O_3 0.60 [O=F, –0.44, H_2O (by difference) 10.04], total 100%, indicating an empirical formula based on (S+P) = 2, of $(Ba_{0.69}Ca_{0.09}K_{0.07}Na_{0.04}REE_{0.02}Sr_{0.01})_{\Sigma 0.92}(Al_{2.92}Fe_{0.02})_{\Sigma 2.94}[(SO_4)_{1.03}(PO_4)_{0.97}](OH)_{5.26}F_{0.26}$. This can be simplified to $(Ba,Ca,K,Na,REE,Sr)(Al,Fe)_3(SO_4)(PO_4)(OH,F)_6$, representing the Ba-analogue of svanbergite and woodhouseite. **D.G.W.S.**

ERRATUM

The original article has an erroneous author list, which is corrected here. This erratum will be linked to the original paper.

Experimental VNIR reflectance spectroscopy of gypsum dehydration: Investigating the gypsum to bassanite transition

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