New Mineral Names*†

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This New Mineral Names has entries for 10 new minerals, including calciummurmanite, czechralskitie, erazoite, honeaite, lobanovite, magnesiovoltaitie, odigitriaitie, romanolovite, tatarinovitie, zinccomite, and a new data on boscadimite and partizite (discredited).

CALCIOMURMANITE*


Calciummurmanite, (IMA 2014-103), with general formula (Na, Ca)2Ca (Ti,Mg,Nb)[Si2O6](OH,OOH)(H2O)n, is a new murmanite-group mineral, the product of hydrothermal or supergene alteration of high-temperature, anhydrous phosphate-bearing titanisotacites lomonosovite and/or betalomonosovite. It was discovered in the specimen ST4994 (V.I. Spepanov collection at Fersman Mineralogical Museum, Moscow, Russia) originally catalogued as betalomonosovite from Mt. Flora, Lovozero alkaline complex, Kola peninsula, Russia. In this specimen (considered as the holotype) calciummurmanite forms irregular lamellae up to 0.1 × 0.4 × 0.6 cm sometimes combined in up to 3 cm aggregates are embedded in a rock mainly consisting of dark-green acicular aegirine and white microcline and containing lorenzenite, fluorapatite and minor calcite. In the mineral forms tabular to acicular crystals, sometimes combined in up to 3 cm aggregates and relics of yellow betalomonosovite.

The mineral has also been found in the outer zone of the Shcherbakovitovoe pegmatite at the Koashva open pit of the Vostochnyi complex, Kola Peninsula, Russia. In this specimen (considered as the holotype) calciummurmanite was refined to 2a = 5.08(9), 2b = 7.08(1), c = 12.15(2) Å, α = 91.85(3), β = 107.72(3), γ = 90.17(3)°, V = 438.1 Å³. The single-crystal unit-cell parameters are: a = 5.349(9), b = 7.077(2) Å, c = 11.60(2) Å, α = 91.85(3), β = 107.72(3), γ = 119.27(3)°, V = 438.1 Å³. The crystal structure of calciummurmanite was refined to R1 = 0.0656 for 1895 reflections. The unit-cell parameters refined from the powder data are: a = 5.349(9), b = 7.08(1), c = 12.15(2) Å, α = 91.85(3), β = 107.72(3), γ = 119.27(3)°, V = 438.1 Å³. The crystal structure of calciummurmanite is isosstructural with murmanite. The structure is based on alternating OH sheet of three polyhedral layers (two heteropolyhedral built up of tetrahedra disilicate groups and Ti-centered octahedra, and one central built up of NaO, and TiO2 octahedra) and intermediate layers (built up of Ca-centered polyhedra and two H2O groups bonded to the apices of Ti octahedra of the H layers and to the Ca-centered polyhedra). A continuous solid solution between calciummurmanite and murmanite is reported.Calciummurmanite is chemically related to another Ca-bearing member of the group is kolskyyite (CaO)((Ti3+),Ge3+)[Fe2+3,Fe3+3,Al5+4,Fe2+6]O2.54(OH)8,(PO4)3.39.(OH)0.61, which has been found in the specimen from the Vostochnyi complex, Kola Peninsula, Russia.

Calciummurmanite does not fluoresce under ultraviolet light (3395, 3250sh), with aegirine, microcline, lamprophyllite, pectolite, and relics of yellow betalomonosovite. Calciummurmanite is brownish (holotype) or purple (cotype), with a nacreous luster on cleavage surfaces and relics of yellow betalomonosovite.

The mineral has also been found in the outer zone of the Shcherbakovitovoe pegmatite at the Koashva open pit of the Vostochnyi complex, Kola Peninsula, Russia. In this specimen (considered as the holotype) calciummurmanite was refined to 2a = 5.08(9), 2b = 7.08(1), c = 12.15(2) Å, α = 91.85(3), β = 107.72(3), γ = 90.17(3)°, V = 438.1 Å³. The single-crystal unit-cell parameters are: a = 5.349(9), b = 7.077(2) Å, c = 11.60(2) Å, α = 91.85(3), β = 107.72(3), γ = 119.27(3)°, V = 438.1 Å³. The crystal structure of calciummurmanite was refined to R1 = 0.0656 for 1895 reflections. The unit-cell parameters refined from the powder data are: a = 5.349(9), b = 7.08(1), c = 12.15(2) Å, α = 91.85(3), β = 107.72(3), γ = 119.27(3)°, V = 438.1 Å³. The crystal structure of calciummurmanite is isosstructural with murmanite. The structure is based on alternating OH sheet of three polyhedral layers (two heteropolyhedral built up of tetrahedra disilicate groups and Ti-centered octahedra, and one central built up of NaO, and TiO2 octahedra) and intermediate layers (built up of Ca-centered polyhedra and two H2O groups bonded to the apices of Ti octahedra of the H layers and to the Ca-centered polyhedra). A continuous solid solution between calciummurmanite and murmanite is reported. Calciummurmanite is chemically related to another Ca-bearing member of the group is kolskyyite (CaO)((Ti3+),Ge3+)[Fe2+3,Fe3+3,Al5+4,Fe2+6]O2.54(OH)8,(PO4)3.39.(OH)0.61, which has been found in the specimen from the Vostochnyi complex, Kola Peninsula, Russia.

Comment: According to the new classification of the seidozerite-supergroup [approved by the IMA-CNMMN (memorandum 56-SM/16) and later published by Sokolova and Cámara (2017)] calciummurmanite belongs to the murmanite group of the seidozerite-supergroup.

Reference cited

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*Czochralskiite (IMA 2015-11) ideally Na₅Ca₃Mg₅(PO₄)₁₆* is the second new phosphate discovered in the Morasko IAB-MG iron meteorite, found in 1914 at the northern edge of the city of Poznań (Poland, 52°29′25.2″N; 16°53′25.9″E). The matrix of the Morasko iron is composed of kamacite (6.0–6.5 wt% Ni) and taenite (17–38 wt% Ni), associated with subordinate tetraedrite (~30 wt% Ni), phosphides (schreibersite and nickelphosphide), carbide (cohenite), occasional sulfides (sphalerite and troilite), and rare altaite. Morasko contains also nodules (up to few centimeters in size) dominated by graphite and troilite. Czochralskiite was found in three of these graphite-bearing nodules, 1–3 mm in size, enclosed in the metal matrix. The nodules also contain schreibersite, cohenite, and a mutually intergrown phosphates: merrillite, brianite, and fluorapatite. Czochralskiite forms xenomorphic, usually oval and amoeboid aggregates, with individual grains ranging from 0.05 to 0.15 mm. No cleavage is observed. The mineral is brittle, with irregular, conchoidal fracture. The indentation hardness VHN = 403 kg mm⁻², corresponding to a Mohs hardness of 4–5. Dₐcalc = 3.14 g/cm³. Czochralskiite is colorless and non-pleochroic, transparent, with vitreous luster and white streak. It is optically biaxial (+), α = 1.608(2), β = 1.611(2), γ = 1.616(2) (589 nm), 2Vₜcalc = 70°(10°), 2Vₜobs = 76°, dispersion (type not specified) is very weak. The orientation is X = a, Y = b, Z = c. The Raman spectrum of czochralskiite shows bands related to four vibrational modes in an ideal (PO₄)³⁻ ion. The most intense bands (966, 974, and 986 cm⁻¹) correspond to the symmetrical stretching vibrations, resulting from three independent phosphate ions in the unit cell. The antisymmetrical stretching vibrations appear as six less intense bands at 1011, 1022, 1039, 1053, 1067, and 1119 cm⁻¹, demonstrating the lowering of PO₄⁻ symmetry. Antisymmetrical O-P-O bending modes are observed as five weak bands at 578, 585, 599, 606, and 616 cm⁻¹, whereas the symmetrical analogs generate a band with a maximum at 441 cm⁻¹, having shoulders at 415, 431, and 450 cm⁻¹. The Raman study shows that CO₃ is absent in the mineral. The average of 12 electron probe WDS analysis [wt% (range)] is: P₂O₅ 46.28 (44.68–46.68), FeO 0.32 (0.08–1.55), MnO 0.16 (0.00–0.31), CaO 27.59 (26.8–28.04), MgO 0.32 (0.08–1.55), MnO 0.16 (0.00–0.31), CaO 27.59 (26.8–28.04), MgO

**Eraゾite* (IMA 2014-061), ideally Cu₅SnS₆, a new hexagonal copper tin sulfide structurally related to covellite, was discovered at the Chilena mine at the El Guanaco Au deposit (25°06′22″S 69°32′10″W), in the Atacama desert (~100 km ENE of Taltal, Antofagasta Province, Chile. The El Guanaco is an epithermal deposit rich in gold, copper, and arsenic, with a strong influence of meteoric waters. It is hosted by volcanic rocks composed of subalkaline dacites, andesites, basalts, and ignimbrites. The mineralization occurs in steeply dipping vuggy quartz veins with disseminated sulfides along vein borders. Ore minerals mostly represented by pyrite, chalcopyrite, enargite, and gold. Eraゾite is enclosed in colorless euhedral baryte crystals up to 1.5 cm associated with alunite, jarosite, olivenite, and scorodite. El Guanaco is famous by secondary Cu-Al arsenates and sulfate mineralization. It is the type locality for ceruleite, guanacoite, lemanskiite, pharmacoalumite, and schlossmannite. In the holotype specimen, eraゾite forms roundish black opaque aggregates up to 0.4 mm of fibrous, frequently radiating black crystals up to ~10 μm wide closely intergrown with chalcopyrite, Sb- and Se-rich bismuthinite, goldfieldite, and enargite. Other minerals in the baryte crystals are covellite, tennantite, and a dull yellow earthy unknown (Sn-Fe-Cu-Ax) mineral (under investigation). Eraゾite has a black streak and submetallic to metallic luster. The hardness estimated by the Kâlb line method corresponds to ~3 of Mohs scale. The density was not measured due to small size of crystals; Dcalc = 4.53 g/cm³. In reflected light eraゾite is gray with no internal reflections observed. The reflectance data were measured in air from 400 to 700 nm with 20 nm intervals. The values for COM wavelengths (Rₑ, Rₛ, nm) are: 21.9, 27.8, 470; 20.4, 26.8, 546; 19.7, 27.2, 589; 20.3, 30.3, 650. The mineral is strongly bireflectant and distinctly pleochroic from pinkish to gray (direction not specified). It is strongly anisotropic with characteristic orange-buff to deep red-brown to muddy green rotation tints. The average of 36 electron probe WDS analyses [wt% (range)] is: Cu 42.46 (41.87–43.47), Sn 20.99 (19.47–22.14), Fe 0.01 (0–0.29), In 0.26 (0.05–0.54), S 34.42 (33.96–34.90), total 98.14. The empirical formula based on 6 S pfu is Cu₅Sn₅S₁₈O₆, SnS₂₅. The strongest lines in the X-ray powder diffraction pattern [d Å (P; hkl)] are: 3.664 (8; 000), 3.265 (8; 010), 3.022 (100; 104), 1.999 (10; 01.13), 1.877 (47; 110), 1.667 (11; 120), 1.592 (12; 024). The unit-cell parameters refined from powder diffraction data are a = 3.756(8) Å, c = 32.91(4) Å, V = 402.1 Å³, Z = 2. Eraゾite is hexagonal, space group R₃m, by analogy with synthetic Cu₅SnS₆ (ICSD 088972). No suitable crystals were found for single-crystal X-ray study. The crystal structure of the synthetic Cu₅SnS₆ is composed of slabs of edge-sharing SnS₆ octahedra sandwiched sharing corners between the sheets of Cu₅S₆-tetrahedra. Those slabs are stacked along [001] and connected via S-S bonds. Some Cu occupies sites close to the center of opposite triangular faces of the SnS₆ octahedra, which requires the center of that octahedron to be vacant. The resulting nearly planar Cu₅S₆ coordination with adjacent Cu₅S₆-tetrahedra is similar to the covellite (CuS) structure. The structure model suggests the substitution of one third of Sn atoms by pairs of Cu atoms. However, the EMPA results show that Cu-Sn substitution in eraゾite is within of about 1 atom% and is equimolar. This might indicate that Sn/Cu substitution also affects the tetrahedrally coordinated Cu-sites. The only two other known natural ternaries in the system Cu–Sn–S, motlite Cu₅Sn₆ and kuramite Cu₅Sn₆, both have Sn in tetrahedral coordination. Eraゾite is named for Gabriel Erazo Fernández (b. 1943) a mining engineer and mineralogist. He was professor of geology, crystallography, and metallurgy at Copiapó University and was the first director of the Mineralogical Museum of
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**HONEYAITE**


Honeyaite, (IMA 2015-60), ideally Au,TlTe2, is a new mineral from the late Archaean Karonie gold deposit, Eastern Goldfields province, Western Australia. The gold deposits are predominantly hosted by quartz amphibolite and, in the northern part of the deposit, minor quartz–biotite-rich metasediments. The largest deposit, where honeyaite was discovered, is the Main Zone orebody, which has a strike length of ~600 m and is ~40 m wide. Specimens containing honeyaite came from borehole KD41 at 78 m, where the sequence is dominated by quartz amphibolite. The rock hosting honeyaite consists predominantly of randomly orientated sheaves of ferrohornblende and mosaic textured calcic plagioclase (An30) with small amounts of orientated ilmenite and pyrite and traces of zircon, and are widely albitized. Honeyaite and other ore minerals form clouds of small (largest ~300 μm, most <100 μm) inclusions roughly following the metamorphic banding, mainly within areas of prehnite alteration of amphibolite. Inclusions consist mainly of gold (low Ag) and tellurobismuthite with small amounts of molybdinite, petzite, hessite, calaverite, melonite, mattagamite, frohbergite, altaite, and others. It forms straw yellow to orange, elongated bladed crystals up to 0.04 mm wide and 0.2 mm long with a vitreous luster and a yellowish-white streak. The new mineral does not fluoresce. Mohs hardness is 3. Honeyaite has a perfect cleavage on {001}, moderate on {010}, and no parting. The density was not measured; Dcalc = 3.161 g/cm³. The optical and DTA data were obtained on different specimen (X-ray laboratory, Hubei Geological College 1974) shows honeyaite is optically biaxial (−), α = 1.658, β = 1.687, γ = 1.710 (589 nm), 2V*: 81.5–83%; Y = b, Z: α = −5 to −6°. The pleochroism is X (bright yellow) > Y (pale yellowish gray) > Z (gray). The DTA curve shows endothermic peaks at 835 °C (strong, escape of OH) and at 900 °C (weak). The average of 10 point WDS electron probe analyses is [wt% (range)]: Nb2O5 0.64 (0.29–1.22), TiO2 13.11 (12.47–13.48), SiO2 39.72 (39.43–39.92), Al2O3 0.24 (0.08–0.42), BaO 0.13 (0.04–0.19), FeO 18.86 (17.98–21.05), MnO 0.21 (3.10–4.59), CaO 0.65 (0.59–0.82), MgO 6.72 (6.05–6.93), K2O 7.66 (7.54–7.78), Na2O 0.42 (4.10–4.29), F 0.29 (0.17–0.43), H2O (by structure refinement) 3.00, −O·F2, 0.12, total 99.33. The empirical formula based on 30 (O+OH) + 0.2 F [Fe6.92Ti12Al8Mn1.46Na1.00Mg2.02Si25O7(H2O)1.38] (OH)1.62 F1.91 is refined to R = 0.033. The structure topology is completely novel and is composed of two components: corrugated double-sheets of six-membered rings of corner-linked TeAu, pyramids, with Te and Au atoms located at apices, and Te having the one-sided threefold coordination that is characteristic of a stereoreactive lone-pair; there is additional intrasheet connectivity via Au–Au bonds. The second component are rows of octahedrally coordinated Ti atoms lying in the grooves of the corrugated sheets. Connections between adjacent TeAu double-sheets involve only Ti–Au bonds. The mineral is named in honor of the late Russell M. Honea (1929–2002) who was a well-known mineralogist in the western U.S.A. and, indeed, globally. Honeyaite appears to be identical to Unnamed Mineral 1993–27 Te:AuTi (Smith and Nickel, 2007). Holotype material is deposited in the Natural History Museum, London, catalogue number BM 2015, 36. F.C.

Reference cited


**LOBANOVITE**


Lobanovite, ideally KNa(Fe2+Mg,Na)Ti3(SiO4)2(OH)3, is a redefined mineral of the astrophyllite group. It was first noted as magnesium astrophyllite with 6.39 wt% MgO (Semenov 1959) with no other data. Later it was reported under the names monoclinc astrophyllite, magnesiumastrophyllite or magnesioastrophyllite (Peng and Ma 1963; Shi et al. 1998; Pilonen et al. 2003 and other papers), but has not been formally approved by the CNMNC, IMA. Based on this study the mineral has been revalidated, approved (CNMNC-IMA: Nomenclature voting proposal 15-B), and named after Konstantin V. Lobanov, a prominent Russian ore geologist who has worked in the Kola Peninsula for more than 40 years. Lobanovite was found in alkaline pegmatites at Mt. Yukspor, Khbinski massif, Kola Peninsula, Russia, in association with shcherbakovite, lamprophyllite, delindeite, wadeite, umbite, krostevyte, and others. It forms straw yellow to orange, elongated bladed crystals up to 0.04 mm wide and 0.2 mm long with a vitreous luster and a yellowish-white streak. The new mineral does not fluoresce. Mohs hardness is 3. Lobanovite has a perfect cleavage on {001}, moderate on {010}, and no parting. The density was not measured; Dcalc = 3.161 g/cm³. The optical and DTA data were obtained on different specimen (X-ray laboratory, Hubei Geological College 1974) shows lobanovite is optically biaxial (−), α = 1.658, β = 1.687, γ = 1.710 (589 nm), 2V*: 81.5–83%; Y = b, Z: α = −5 to −6°. The pleochroism is X (bright yellow) > Y (pale yellowish gray) > Z (gray). The DTA curve shows endothermic peaks at 835 °C (strong, escape of OH) and at 900 °C (weak). The average of 10 point WDS electron probe analyses is [wt% (range)]: Nb2O5 0.64 (0.29–1.22), TiO2 13.11 (12.47–13.48), SiO2 39.72 (39.43–39.92), Al2O3 0.24 (0.08–0.42), BaO 0.13 (0.04–0.19), FeO 18.86 (17.98–21.05), MnO 0.21 (3.10–4.59), CaO 0.65 (0.59–0.82), MgO 6.72 (6.05–6.93), K2O 7.66 (7.54–7.78), Na2O 0.42 (4.10–4.29), F 0.29 (0.17–0.43), H2O (by structure refinement) 3.00, −O·F2, 0.12, total 99.33. The empirical formula based on 30 (O+OH) + 0.2 F [Fe6.92Ti12Al8Mn1.46Na1.00Mg2.02Si25O7(H2O)1.38] (OH)1.62 F1.91 is refined to R = 0.033. The structure topology is completely novel and is composed of two components: corrugated double-sheets of six-membered rings of corner-linked TeAu, pyramids, with Te and Au atoms located at apices, and Te having the one-sided threefold coordination that is characteristic of a stereoreactive lone-pair; there is additional intrasheet connectivity via Au–Au bonds. The second component are rows of octahedrally coordinated Ti atoms lying in the grooves of the corrugated sheets. Connections between adjacent TeAu double-sheets involve only Ti–Au bonds. The mineral is named in honor of the late Russell M. Honea (1929–2002) who was a well-known mineralogist in the western U.S.A. and, indeed, globally. Honeyaite appears to be identical to Unnamed Mineral 1993–27 Te:AuTi (Smith and Nickel, 2007). Holotype material is deposited in the Natural History Museum, London, catalogue number BM 2015, 36. F.C.

Comment: The mineral is widely distributed in Khbinski alkaline massif, mostly in r fissurorite pegmatites related to the ijolite-urtite arc with apatite deposits. Sometimes it forms pseudomorphs after

**Reference cited**

aegirine-diopside but most commonly occurs as scaly aggregates up to 15 cm with the very specific bronze-green color. Its physical, including optical properties, chemical composition, density, IR spectra, etc., were described in detail (under the name magnesioastrophyllite) for the different morphological varieties and associations (Kostyleva et al. 1978).

References cited


MAGNESIOVOLTAITE


Magnesiovoltaite, ([IMA 2015-95], ideally K,Mg,Fe³⁺Al(SO₄)₁₂·18H₂O, is a new voltaite-group mineral, discovered in the Alcaparrosa mine, Cerro Alcaparrosa, El Loa province, Antofagasta region, Chile. The Alcaparrosa polymeric sulfide deposit consists of a series of iron sulfate veins and lenses of varying strikes and dips, hosted in volcanic rocks of the Punta del Cabre Formation composed mainly of massive andesitic and dacitic rocks. Magnesiovoltaite occurs in two mineral assemblages: as crystals growing on coquimbite, associated with tamarugite, alumina (Na), rhomboclase, yayapaitie, voltaite, and opal; as yellow crystals overgrowing a matrix mainly consisting of botryogen and opal with tamarugite, alumin (K), pickeringite, magnesiocepiaptie, and jarosite or natrojarosite. Magnesiovoltaite forms transparent amber-yellow to 2½. The unit cell parameter refined from powder data is 1.79 = 27.17(1) Å, V = 20057 Å³. X-ray diffraction pattern on an anhedral crystal of 0.13 × 0.13 × 0.17 mm yielded unit-cell parameter: a = 27.161(1) Å, V = 20037 Å³, cubic, Fd3c, Z = 16. The crystal structure was refined to R = 0.0321 for 1147 independent reflections with I > 2σ(I). The magnesiovoltaite is isostructural with other members of the voltaite group. Based on the refined site-scattering factors, the crystal-chemical formula of magnesiovoltaite can be written as follows (Z = 16): [K(Mg,Fe³⁺,Mn,Zn)](H₂O)₁₂[[Fe⁵⁺Fe²⁺Fe³⁺Mn,Zn]₂(H₂O)₁₂]₅Fe²⁺(SO₄)₂, where the composition of the heteropolyhedral framework is put in figure brackets. The mineral is named as an analog of voltaitc and zincovoltaite with Mg dominant at the M1. The holotype and cotype specimens are deposited in the collections of the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. F.C.

ODIGITRIAITE


Odigitriaite ([IMA 2015-028], ideally CsNa₂Ca₃[Si₁₂B₈O₃₈]F₂, was discovered in the moraine adjacent to the Darai-Pioz alkaline massif in the upper reaches of the Darai-Pioz river at the joint of Turkestan, Zeravshan and Ayak mountain ridges, Tajikistan. The name originates from the Greek Οδηγήτρια, meaning “she who shows the way,” it was named odigitriaite to emphasize the role of Cs as a major indicator of extreme fractionation. Odigitriaite was discovered in cobbles and boulders of anhedral quartz range in size from 5 to 80 cm, which contain inclusions of slightly deformed stacks of polylichonite, crystals of pale-green to white microcline, patches of pale-pink reedmergnerite, randomly distributed black idiomorphic crystals of aegirine, rare red-brown translucent crystals of stillwellite-(Ce), grass-green translucent to transparent crystals of leucopinelle, yellow pinke platelets of sodgianite, dark-green crystals of turkestanite and brown patches (up to 30 cm) of peotolite. Odigitriaite occurs in these peotolite brown patches associated with Sr-rich fluorite, peokovite, mendeleevite(Ce), orlovite, kirchoffite, neptunite, zervanhanite, serenkovite, nortdemic-(Ce), alamosite, hyalotekite, and khvorovite. It forms irregular elongated grains up to 100 μm. Odigitriaite is colorless, translucent, with a white streak and a vitreous luster. It does not fluoresce under the UV light. Odigitriaite has a perfect cleavage on {001} with no parting. It is brittle with an uneven fracture. Indentation hardness VHN = 566 (560–65) kg/mm² corresponds to Mohs hardness of 5. D_{max} = 2.80(2) and D_{min} = 2.830 g/cm³). In transmitted light the mineral is colorless, non-pleochroic and, despite the cubic symmetry, show quite noticeable anisotropy: largest grains often show conoscopic figures of a negative uniaxial crystal with ε = 1.584(2) and δ = 1.588(2) (589 nm); some smallest fragments show biaxial (–) a = 1.584(2), β = 1.587(2), and γ = 1.588(2) with weak to medium dispersion of optical axes, r > v and 2Fv = 60°. The FTIR spectrum of magnesiovoltaite is similar to the one of voltaitc: (cm⁻¹; s = strong band, w = weak band, sh = shoulder) 3565sh, 3480sh, 3441, 3134 (3070sh) (O–H stretching of H₂O), 2496w (O–H stretching of HSO₄ groups), 1684w, 1640sh, 1624 (bending of H₂O), 1168s, 1133s, 1067s [v₁(F₂) = asymmetric stretching vibrations of SO₄²⁻ ions], 1011s, 995sh [v₁(A₂) = symmetric stretching of SO₄²⁻], 876w, 718sh (possibly, M···O–H bending combined with overtones of M···O stretching), 660sh, 629, 596 [v₂(F₂) = bending of SO₄²⁻], 440 [Fe⁵⁺O–O stretching and/or v₁(E) bending mode of SO₄²⁻]. The average of an unreported number of electron probe EDS analyses is [wt% (range)]: Na₂O 0.13 (0–0.25), K₂O 4.64 (4.43–4.77), MgO 9.13 (8.52–9.73), MnO 1.73 (1.64–1.94), ZnO 0.85 (0.53–1.22), Al₂O₃ 2.47 (2.23–2.84), Fe₂O₃ (by Mossbauer) 13.36 (12.96–13.68), SO₃ 50.83 (50.34–51.38), H₂O 17.6 ± 0.5 (by gas chromatography), total 100.73. The empirical formula based on 66 O pfu is (K₁.62Na₀.18)(Mg₂.85Mn₀.12Zn₀.07)Fe⁵⁺Al₂SO₄(H₂O)₁₂·18H₂O. The strongest reflections of the calculated powder X-ray diffraction pattern are [d Å (Pc; hkl)]: 9.56 (29; 022), 6.77 (37; 004), 5.53 (61; 224), 3.532 (68; 137), 3.392 (100/008), 3.034 (45; 048), 2.845 (30; 139). The unit cell parameter refined from powder data is a = 27.17(1) Å, V = 20057 Å³. X-ray diffraction pattern on a anhedral crystal of 0.13 × 0.13 × 0.17 mm yielded unit-cell parameter: a = 27.161(1) Å, V = 20037 Å³, cubic, Fd3c, Z = 16. The crystal structure was refined to R = 0.0321 for 1147 independent reflections with I > 2σ(I)
anions with (F–OH) = 2 afpu is C₆H₁₂O₆Na₄Ca₄₄Mn₂₀₂VO₆Fe₄₄Pb₂₄₁₂ [Si₁₁₂O₄₄B₂₄₂O₄₄]F₁₃(OH)₂. Powder X-ray diffraction data were not collected due to the paucity of the material but the three-dimensional diffraction data were collapsed into two directions to be representative of the chemical composition and crystal structure of the new mineral. The strongest lines of the diffraction pattern are [d (Å, hkl)]: 5.45 (25; 113), 4.66 (33; 311), 4.40 (20; 022), 4.10 (36; 313), 2.85 (31; 222), 2.68 (40; 006), 3.62 (45; 024), 3.35 (100; 224), 3.31 (30; 315), 3.25 (35; 404), 3.04 (60; 422), 2.925 (22; 23), 1.813 (23; 910). The crystal structure of odigitriaite was solved by direct methods and refined to R = 2.75%. The new mineral is monoclinic, C2/c, a = 16.652(5), b = 9.598(3), c = 22.1207(14), β = 92.875(14)°, V = 3530.9 Å³, and Z = 4. The crystal structure of odigitriaite is based on Na-a layers of [SiO₄] and [H₂SiO₄] tetrahedra. Cs and Na are intercalated within the double-layer sheet, and the double layers are linked by interstitial Ca and Na atoms. The holotype specimen was deposited in the Fersman Mineralogical Museum, Russian Academy of Science, Moscow, Russia. Yu.U.

**ROMANROLOVITE**


Romanrolovite (IMA 2014-011), is a new tetragonal K-Cu hydroxychloride with simplified chemical formula K₁(CuCl₂·2H₂O). It was discovered in upper, moderately hot zones of two fumaroles, Glavnyaya Tenoritovaya and Arsenatnaya, at the Second scoria cone of the Northern Breakthrough of the Great Tolbachik Fissure Eruption, Tolbachik volcano, Kamchatka, Russia. The association in the Arsenatnaya fumarole includes avdoninite along with earlier crystalized hematite, pseudobrookite, clinoenstatite, diopside, anhydrite, powellite and baryte. In Glavnyaya Tenoritovaya the mineral is associated with avdoninite, beloite, sylvinite, carnallite, mitchellrite, sanguite, chlorothionite, eriochalcite, chrysollite and mellizankinite. Romanrolovite forms yellow-brown to dark brown prismatic, equant or tabular tetragonal crystals up to 0.1 mm (tiny crystals are honey- or golden-yellow) with main forms {100}, {110}, and {001}, crystal clusters up to 0.5 mm and crystals up to 2 × 2 mm in area. The mineral is transparent, vitreous with a yellow streak. Cleavage was not observed. Romanrolovite is brittle with Mohs hardness of ~3. D_{meas} = 2.61(1); D_{calc} = 2.72–2.79 g/cm³ in agreement with Pb content. Significantly lower value of measured density is due to the porous nature of the crystals. Placed into the water at room temperature romanrolovite hydrolyzes in a first few seconds (grains becoming dull) and then easily dissolves. Romanrolovite hydrolyzes with Mohs hardness of ~3. D_{meas} = 2.61(1); D_{calc} = 2.72–2.79 g/cm³ in agreement with Pb content. Significantly lower value of measured density is due to the porous nature of the crystals. Placed into the water at room temperature romanrolovite hydrolyzes in a first few seconds (grains becoming dull) and then easily dissolves.

Romanrolovite is optically uniaxial (−), ω = 1.727(3), ε = 1.694(2). In transmitted plane-polarized light the mineral is yellow-brown, non-pleochroic. It is optically uniaxial (−), ω = 1.727(3), ε = 1.694(2). In transmitted plane-polarized light the mineral is yellow-brown, non-pleochroic.

**TATARINOVITE**


Tatarinovite (IMA 2015-055), is a new hexagonal member of the ettringite group with an ideal chemical formula Ca₅Al₂(SO₄)₄[B(OH)₄] (OH)₁₂·H₂O. It has been discovered at the Bazhenovskoe chrysoelite asbestos deposit (near the town of Asbest, Middle Urals, Russia) in the cavities of rodinite body ~1.5 m thick and a few hundred meters long at the contact between the dike of partly rodinitized gabbroic rock and hosting serpentinite. Rodinite consists mostly of grossular, diopside, and clinochlore with some vesuvianite, clinozoisite, prehnite, tremolite, serpentine, and calcite. In peripheral part of rodinite body tataninovite forms colorless, vitreous, dipyramidal (104) crystals up to 1 mm (0.5 mm in average) in cavities within massive diopside, in association with xenotite, clinochlore, pectolite, and calcite. Both in periphery and in central part of rodinite body tataninovite also found as white granular sugary aggregates up to 5 mm on grossular with pectolite, diopside, calcite, and xenotite. The mineral has a white streak, perfect cleavage on {100} and Mohs hardness ~3. D_{meas} = 2.79(1) and D_{calc} = 2.779 g/cm³. The fluorescence in UV light was not observed. In transmitted light tataninovite is colorless, non-pleochroic. It is optically uniaxial (+), ω = 1.475(2), ε = 1.496(2) (589 nm). The IR spectrum contains the (cm⁻¹): 1227w, 1180w (asymmetric stretching of HSO₄).
NEW MINERAL NAMES

1195sh (B–O bending of B(OH)2 and B(OH)4), 1144s (asymmetric bending of SO2), 991, 953 (B–O stretching and B–O–H bending vibrations of B(OH)3), 879 (out of plane bending vibrations of CO3), 726sh (Si–O stretching in SiOH, octahedra), 675s, 645sh, 595 (SO2 bending), 555 (Al–O stretching in Al(OH)2, octahedra), 501 [O–Si–O bending of Si(OH)3], 417 (O–Al–O bending of Al(OH3). Quantitative electron probe analysis was not performed due to instability of the mineral under the beam. Semiquantitative analysis show the presence only B, Ca, Al, Si, and minor Fe in detectable amounts. The chemical composition (ICP-AES) of tatarinovite [wt% (range)] is: CaO 27.40–39.16, Al2O3 15.72–24.06, SiO2 11.94–23.00, SO3 2.55–3.98, CO2 0.35 (0.33–0.37), SiO2 2.43 (2.34–2.52), SO3 8.48 (8.46–8.49), CO2 4.2 (3.9–4.5)*, H2O 46.12 (2.9), total 99.04 (± determined by selective sorption of gaseous products of annealing). The empirical formula based on 3 Ca pfu is: H11.33Ca0.82Al2.05Si1.56O12.05. The strongest reflections of the powder X-ray diffraction pattern [d Å (I%), (hkl)] are: 9.63 (100; 100), 5.556 (30; 110), 4.654 (14; 102), 3.841 (21; 112), 3.441 (12; 211), 2.746 (10; 302), 2.538 (12; 213). The unit-cell parameters refined from the powder XRD data are: a = 11.1161(1) Å, c = 10.6265(5) Å, V = 1137.1 Å3. The single-crystal unit-cell parameters are: a = 11.1110(4) Å, c = 10.6294(6) Å, V = 1136.4 Å3, Z = 2, space group P63. The crystal structure solved by direct methods and refined to R1 = 0.0252 for 9846 /2 > 2σ(I) reflections. Tatarinovite is the structural analog of thumarsite with Al dominating over Si in octahedral position. Its structure is based on infinite columns along c axis with composition of [(Ca,Al)(Si,Al)(OH,Al)(OH,Al)] consisting of octahedrals [(Al,Al)(OH,OH)] and polyhedra Ca(OH)(OH,Al). In thumarsites those columns are connected by a hydrogen bonds with groups of SO2 and (CO2)2 which are alternating along c axis and are completely ordered. In tatarinovite anions (SO2)2–, [BH4]–, (CO2)2– and, in one position, B(OH)4– are also between columns but strongly disordered. The sites occupied by S and C atoms in thumarsite in tatarinovite occupied by S, B, and C with statistical distribution leading to the crystal-chemical formula: Ca4(BH4)4(SO4)3[B(OH)4]2(Al3O2)24{(SO4)2[Al3O2][B(OH)4]24 [CO3]3[32][B(OH)4]3[OH,2][O2]2}12H2O. Tatarinovite was named in honor of the Russian geologist and petrologist Pavel Mikhailovich Tatarinov (1895–1976), a well-known specialist in deposits of chrysotile asbestos. Type specimens are deposited in the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. D.B.

ZINCOMENITE*

Zincomenite (IMA 2014-014), β-ZnSeO3, a new orthorhombic zinc selenite, was discovered in active fumaroles at the Northern fumarole field, First scoria cone, Northern Breakthrough of the Great Tolbachik Fissure Eruption, Tolbachik Volcano, Kamchatka, Russia. The mineral was found at 0.1–0.3 m depth from the surface where the temperatures during collecting were 180–200 °C. It occurs in white to gray sublimate incrustations mainly consisting of sellaite, fluiture, halite, and anhydrite. Common minerals on that crust are cotinite, sofitite, and flintite. Subordinate minerals are anglesite, chubarovite, chalacolette, obsidierite, saltonseait, hollandite, bixbyte, jacobobunite, sylite, hematite, and baryte. In upper part of the fumarole cryoosbyrite, leonardsenite, ralstonite, gypsum, vernadite, and opal are formed as products of the supergene alteration of sublimate minerals. Zincomenite forms tabular, equant or prismatic crystals up to 0.2 mm sometimes combined in dense crystal clusters up to 0.3 mm across, chain-like crystal groups up to 0.35 mm long, or interrupted incrustations up to 0.7 × 1 cm overgrowing basalt scoria. Partial to complete pseudomorphs of zincomenite after sofitite are typical. The crystal forms are {101}, {101}, {100}, and {013}. T-shaped twins with {012} as twin plane were found. Zincomenite is transparent, colorless (in separate crystals), white or pale beige (in aggregates) with white streak and adamantine luster. The fluorescence under UV radiation or electron beam was not observed. It is brittle with an uneven fracture. Cleavage and parting were not observed. Mohs hardness and density were not measured due to the size of the crystals; Dcalc = 4.760 g/cm3. In transmitted light zincomenite is colorless, non-pleochroic. It is optically biaxial (−, α = 1.744(5), β = 1.860(5), γ = 1.875(5) (589 nm), 2V was estimated as medium; 2Vcalc = 38°. Optical orientation is not given. Dispersion of the optical axes was not observed. Due to the insufficient amount of material, scattering, and atmospheric noise the IR spectrum of acceptable quality was obtained only in the region below 1800 cm−1. The spectrum of zincomenite is close to that of its synthetic analog. The absorption bands (cm−1, s = strong, w = weak) are: 845, 826, 818, 754, 728s, 697s (stretching vibrations of SeO2), 532, 483w (bending vibrations of SeO2) possibly combined with stretching vibrations of ZnO, polyhedra. Bands due to SeO2 are not observed and the absence of absorptions in the range 900–1800 cm−1 indicates the absence of O–H, C–O, and B–O covalent bonds. The average of 5 electron probe WDS analysis [wt% (range)] is: ZnO 42.53 (42.08–43.15), SeO2 56.67 (55.49–57.58), total 99.20. The empirical formula calculated on the basis of 3 O pfu is: Zn18.92Se26.90O39. The strongest reflections of the powder X-ray diffraction pattern [d Å (I%); (hkl)] are: 4.612 (26; 102), 3.601 (77; 200), 3.19 (48; 210), 3.048 (38; 113), 3.014 (100; 211), 2.96 (56; 904), 2.771 (19; 123,104,212), 2.459 (23; 213,023), 2.311 (20; 123,221,204), 2.162 (19; 214,024). The orthorhombic unit-cell parameters refined from the powder data are: a = 7.199(1), b = 6.238(1), c = 12.00(2) Å, V = 539.2 Å3. The single-crystal unit-cell parameters are: a = 7.1971(2), b = 6.3230(2), c = 11.9914(3) Å, V = 537.84 Å3, Z = 8, space group Pbcn. The crystal structure was solved by direct methods and refined to R = 0.0188 for 786 independent I > 2σ(I) reflections. Zincomenite is a representative of the CuSeO3 structure type. The crystal structure contains layers formed by ZnO2 dimers (consisting of edge-sharing ZnO2 trigonal bipyramids; each dimer shares four vertices with the neighboring ones) linked via (SeO2)2– groups with Se2+ in trigonal pyramidal coordination) to form an open framework. β-ZnSeO3 is the high-temperature modification and can be obtained from α-ZnSeO3 by heating that to 285 °C. The reverse transformation from beta- to alpha-form of ZnSeO3 does not occur, i.e., both synthetic α-ZnSeO3 and zincomenite are stable at room temperature. The stability field of β-ZnSeO3 extends until ~450 °C. Zincomenite could be deposited directly from the gas phase as a volcanic sublimate (well-shaped crystals). Alternatively the new mineral (or its hypothetical proto-phase α-ZnSeO3, if the process was occurring at a temperature lower than ca. 280 °C) could be formed as the result of the reaction between fumarole gases and sofitite Zn2(SeO3)Cl (pseudomorphs). The mineral is named in allusion to its chemical composition: zinc selenite (the Greek μενατ, means moon, indicating selenium). The type specimen have been deposited to the Fersman Mineralogical Museum Russian Academy of Sciences, Moscow, Russia. D.B.

NEW DATA
BOSCARDINITE

Boscardinite, ideally TlPb5(Sb-As)3S16, triclinic homeotypic derivative of baumhauerite has been described recently from quartz
veins with zinkenite in Monte Ariscio mine, Apuan Alps, Tuscany, Italy, and in intimate intergrowth with stibnite and smithinite from the Jas Roux thallium mineralization, Hautes-Alpes, France. New finds of boscardinite (compact black masses up to 1 cm with protochabournéite and routhierite) in Monte Ariscio mine in the microcrystalline baryte-pyrite ore bodies, at the contact between schist and dolostone and in the pyrite-rich dolostone allowed to obtain new crystal-chemical data. The single-crystal X-ray diffraction study confirms the structural features of boscardinite collected in the Sant’Olga level used for the single-crystal X-ray diffraction study [w% (range):] Ag 1.81 (1.77–1.87), Tl 12.60 (12.39–12.82), Pb 17.99 (17.85–18.09), Hg 0.14 (0.1–0.2), As 9.36 (9.23–9.46), Sb 33.60 (33.28–33.77), S 23.41 (23.09–23.70), Cl 0.06 (0.05–0.07), total 98.97. A similar data was obtained on another specimen of boscardinite collected at the pyrite-rich dolostone allowed to obtain new crystal-chemical data. The partzite, DisCreDiteD [w% (range):] Ag 8.6597(4), Pb 20.57 (20.46–20.79), Hg 0.13 (0.1–0.16), As 8.24 (8.22–8.24), Sb 33.48 (33.39–33.55), S 22.89 (22.81–22.96), Cl 0.05 (0.03–0.08), total 98.20. On the basis of ΣMe = 14 apfu, it corresponds to Ag₉₋₁₀(Pb₂₋₃Tl₁₋₂)Sb₂₋₃As₂₋₃Cl₁₋₄ respectively (Z = 2). There is a strong Pb depletion and a significant Tl and As enrichment compare to type specimen of boscardinite.


Partzite was originally described by Arents (1867) as a hydrous oxide of antimony and mixed metallic oxides from the Blind Spring Mountains, Mono County, California, U.S.A. It was considered to be identical with “cuproromeite” Cu₅Sb₂(O,OH), with a questionable status since no cation site in pyrochlore structure is stereochemically favorable for Cu²⁺, and no synthetic Cu antimonates with the pyrochlore structure are known. The type specimen #80284, from the mineralogical collections of Harvard University, Cambridge, Massachusetts, U.S.A., has been re-investigated by powder X-ray diffraction and electron microprobe traverses. The type specimen consists of an olive green to dark green botryoidal-coilloform gel-like crust on tetrahedrite, with a transparent blue phase coating the crust. The material shows complex layering on the submicrometer scale, and consists of several distinct phases which could not been fully resolved by electron probe. The X-ray powder diffraction data shows that the partzite sample is very poorly crystalline. The background is high and irregular, featuring the presence of amorphous matter. The few visible peaks correspond to d = 6.03, 3.60, 2.99, 1.83 and 1.56 Å, consistent with the 111, 220, 222, 440, and 622 reflections from the cubic pyrochlore structure type with the unit-cell parameter a = 10.358 Å which is close to that observed for oxyplumboromeite (10.378). However (Pb⁺Ca)/Sb ratio is too low for that species. If Fe is trivalent and is in Pb site a charge-balanced formula could be (PbO₆CaO₅[(OH)₅O]₆SbO₄FeO₂(OH)₅O)₆(H₂O). There is no evidence for significant Cu content in the pyrochlore phase. Copper is predominantly in a silicate phase resembling chrysocolla, but with an unusually high Cu/Si ratio of ~1.3. Thus, the correlations between elements along with XRD indicates that the two dominant phases are a plomboromeite-like oxide phase and a chrysocolla-like amorphous Cu silicate. The analysis also suggested the presence of several minor phases that were too scarce to be detectable by XRD, including acanthite, chlorargyrite, baryte, halite, and an Al-rich clay mineral. Subsequently partzite is discredited as a valid mineral species. This has been approved by the IMA CNMNC (proposal 16-B). D.B.

Reference cited