NEW MINERALS

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Artsmithite

\[
\text{Hg}^{1+} \frac{3}{4} \text{Al}(\text{PO}_4)_{2-x}(\text{OH})_{1+3x} \ (x = 0.26)
\]

MONOCLINIC

Locality: The Funderburk prospect (Lat. 34.177° N, Long. 93.659° W), north of Cowhide Cove road, Cowhide Cove Recreation area, on Lake Greeson, approximately 13 km north of Murfreesboro, Pike County, Arkansas, USA.

Occurrence: In fractures in the Jackfork sandstone, with cinnabar, quartz and dickite and other mercury minerals (calomel, eglestonite, mercury, metacinnabar, montroydite, terlinguaita).

General appearance: A matted nest (approximately 3 × 1 mm) of randomly scattered fibrous to acicular crystals.

Physical, chemical and crystallographic properties: Luster: stated to be vitreous, but the optical data indicate adamantine. Diaphaneity: transparent. Color: colorless. Streak: off-white to cream. Luminescence: nonfluorescent. Hardness: could not be determined. Tenacity: needles are flexible. Cleavage: none. Fracture: irregular. Density: could not be measured, 6.37 g/cm³ (calc.). Crystallography: Monoclinic, \( \text{C}_2/c \). \( a = 17.022, \ b = 9.074, \ c = 7.015 \text{ Å}, \ \beta = 101.20°, \ V = 1062.9 \text{ Å}^3, \ Z = 4, \ \frac{a}{b} = 1.8759, \frac{1}{c} = 0.7731 \). Morphology: no forms could be identified. Twinning: none mentioned. X-ray powder-diffraction data: \( 8.326(100)(200), 4.739(50)(310), 2.979(80)(202), 2.952(50)(\bar{4}02), 2.784(80)(600), 2.660(75)(330), 1.755(50)(640,\bar{2}04) \). Optical data: Biaxial (+), indices of refraction could not be measured, but the mean value calculated from the Gladstone–Dale relationship is 1.94 to 1.99, \( 2V(\text{meas.}) \) approximately 60°, dispersion \( r < v \), distinct; parallel extinction and length slow with \( Z \approx c \). Chemical analytical data: One set of electron-microprobe data (with H₂O calculated by stoichiometry): \( \text{Hg}_2\text{O} 78.28, \text{Al}_2\text{O}_3 5.02, \text{P}_2\text{O}_5 11.39, \text{H}_2\text{O} (1.63), \text{Total} (96.32) \text{ wt.} \% \). Empirical formula: \( \text{Hg}_{3.97}\text{Al}_{1.04}(\text{PO}_4)_{1.70}(\text{OH})_{1.91} \), Relationship to other species: None apparent.

Name: After Arthur (“Art”) E. Smith (b. 1935), who collected the mineral.


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Bobjonesite
\[ V^{4+}O(SO_4)(H_2O)_3 \]

**Locality:** The North Mesa 5 mine, SW ¼ of section 35, and the adjacent eastern edge of section 34, Township 24 South, Range 11 East, Emery County, Utah, USA.

**Occurrence:** In a silicified tree in the Shinarump conglomerate. The tree has a rim of coal 6 to 25 mm thick. Associated minerals are: ferriciopiapite, kornelite, rozenite, szomolnokite, sulfur, montroseite, anorthominasragrite, orthominasragrite, minasragrite and an unidentified yellow-green hydrated Fe–V sulfate.

**General appearance:** Crusts and efflorescences with individual grains << 1 mm.

**Physical, chemical and crystallographic properties:** The mineral is unstable in all but the driest air and hydrates easily. Consequently, some of the following properties were determined from synthetic material. **Luster:** vitreous. **Diaphaneity:** Not given, but probably transparent to translucent. **Color:** pale blue. **Streak:** pale blue. **Luminescence:** nonfluorescent in ultraviolet light. **Hardness:** approximately 1. **Tenacity:** not given. **Cleavage:** not observed. **Fracture:** not given. **Density:** could not be measured because of the instability of the mineral, 2.28 g/cm³ (calc.). **Crystallography:** Monoclinic, \( P_{2_1}/n \), \( a = 7.394, b = 7.411, c = 12.0597 \) Å, \( \beta = 106.55^\circ \), \( V = 633.5 \) Å³, \( Z = 4, \alpha: \beta: \gamma = 0.9977:1:1.6272 \). **Morphology:** no forms were mentioned. **Twinning:** none mentioned. **X-ray powder-diffraction data:** 6.962(11)(101), 6.255(11)(011), 5.795(100)(002), 5.408(37)(101), 4.571(20)(012), 3.881(48)(103), 3.498(90)(112), 3.423(10)(013). **Optical data:** Biaxial (+), \( \alpha = 1.555, \beta = 1.561, \gamma = 1.574 \), 2V(meas.) 72°, 2V(calc.) 69°; dispersion not mentioned; nonpleochroic; \( X = b, Y = a, Z \approx c \approx 19^\circ \) in obtuse angle \( \beta \). **Chemical analytical data:** Because of the instability of the mineral, an electron-microprobe analysis could not be carried out. The ideal formula requires: VO 2 38.21, SO3 36.88, H2O 24.91, Total 100.00 wt.%. **Relationship to other species:** Anorthominasragrite (triclinic), orthominasragrite (orthorhombic) and minasragrite (monoclinic) are polymorphs of the higher hydrate \( V^{4+}O(SO_4)(H_2O)_5 \).

**Name:** After Robert (Bob) Jones (b. 1926), of Cave Creek, Arizona, USA, in recognition of his enormous contribution to the mineralogical community.

**Comments:** IMA No. 2000–045A. The crystal structure has been determined.

**Borocookeite**

\[ \text{Li}_{1+3x}\text{Al}_{4-x}(\text{BSi}_3)\text{O}_{10}(\text{OH},\text{F})_8 \]

**Locality:** The Sosedka and Mokhovaya pegmatite veins, Malkhan pegmatite field, Krasny Chikoy area, Chita region, Russia.

**Occurrence:** In pockets of pegmatites. Associated minerals are: elbaite, lepidolite, danburite, boron-rich muscovite, laumontite, quartz and albite.

**General appearance:** Massive nearly monomineralic aggregates or thin (0.5 to 2 mm) crusts and snow-like coatings on other minerals.

**Physical, chemical and crystallographic properties:**

- **Luster:** greasy.
- **Diaphaneity:** given as “not transparent”, so presumably translucent. **Color:** light gray with a pinkish or yellowish hue. **Streak:** light pinkish gray. **Luminescence:** not given. **Hardness:** 3. **Tenacity:** given as “not elastic”. **Cleavage:** {001} perfect. **Fracture:** not observed. **Density:** 2.62 g/cm³ (meas.), 2.68 g/cm³ (calc.).
- **Crystalllography:** Monoclinic, space group not given but probably \( \text{Cc} \) by analogy with cookeite, \( a \ 5.110, b \ 8.856, c \ 14.080 \ \text{Å}, \beta \ 96.93^\circ, V \ 632.2 \ \text{Å}^3, Z = 2, a:b:c = 0.5768:1:1.5881 \). Morphology: no forms were mentioned. Twinning: none mentioned. **X-ray powder-diffraction data:** 7.05(50)(002), 4.71(70)(003), 3.512(100)(004), 2.807(20)(005), 2.332(14)(006), 2.304(16)(202), 1.946(17)(204).
- **Optical data:** Biaxial (+), \( \alpha \ 1.574, \beta \ 1.580, \gamma \ 1.591, \ 2\nu \text{could not be measured, } 2\nu(\text{calc.}) \ 73^\circ; \text{dispersion not determined; nonpleochroic; } Z = \text{elongation.} \)
- **Chemical analytical data:** Analysis by wet chemistry (\( \text{B}_2\text{O}_3, \text{BeO}, \text{H}_2\text{O}, \text{F} \)), flame photometry (\( \text{Li}_2\text{O}, \text{Rb}_2\text{O}, \text{Cs}_2\text{O} \)) and electron microprobe (\( \text{SiO}_2, \text{TiO}_2, \text{Al}_2\text{O}_3, \text{FeO, MnO, MgO, CaO, K}_2\text{O, Na}_2\text{O} \)) gave (after deduction of about 2 wt.% quartz and recalculaton to 100 wt.%): \( \text{Li}_2\text{O} \ 0.65, \text{Na}_2\text{O} \ 0.01, \text{K}_2\text{O} \ n.d., \text{Rb}_2\text{O} \ 0.004, \text{Cs}_2\text{O} \ 0.005, \text{BeO} \ 0.05, \text{MgO} \ 0.04, \text{CaO} \ 0.08, \text{MnO} \ 0.07, \text{FeO} \ 0.06, \text{B}_2\text{O}_3 \ 4.06, \text{Al}_2\text{O}_3 \ 41.77, \text{SiO}_2 \ 34.19, \text{TiO}_2 \ 0.02, \text{H}_2\text{O} \ 14.28, F \ 1.22, \text{sum} \ 100.51, \text{less O=F} \ 0.51, \text{Total} \ 100.51 \text{wt.\\%}. \)**

Empirical formula:

\[
(\text{Li}_{1.59}\text{Ca}_{0.08}\text{Mg}_{0.01}\text{Mn}_{0.01})\text{Al}_{3.66}(\text{Si}_{1.90}\text{Al}_{0.50}\text{B}_{0.05}\text{Be}_{0.01})\text{O}_{10}\text{F}_{0.33}\text{OH}_{8.08}\text{O}_{5.841}
\]

**Relationship to other species:** It is the boron-dominant analogue of cookeite.

**Name:** Recalls the relationship to cookeite.

**Comments:** IMA No. 2000–013.

Brinrobertsite

An ordered, mixed-layer dioctahedral pyrophyllite–smectite

MONOCLINIC

Locality: 750 m northeast of Penrhyn castle, near Bangor, North Wales, UK.

Occurrence: In a metabentonite within a sequence of dark gray mudstones. Associated minerals are: quartz and a chlorite-group mineral.

General appearance: Anhedral grains in aggregates up to 0.02 mm across. Individual grains are less than 1 μm.

Physical, chemical and crystallographic properties: Luster: dull to vitreous. Diaphaneity: translucent. Color: gray to yellowish gray. Streak: gray. Luminescence: not mentioned. Hardness: close to 1. Tenacity: not given. Cleavage: {001} as observed by TEM. Fracture: not given. Density: could not be measured or calculated. Crystallography: Monoclinic or pseudo-monoclinic, \( d_{100} 5.2, b 9.1, d_{001} 24 \text{ to } 25 \text{ Å} \). Morphology: no forms were observed. Twinning: none observed. X-ray powder-diffraction data: Air dried: 22.29(48){001}, 10.99(100){002}, 7.32(2){003}, 5.48(7){004}, 4.47(3){005}, 3.17(33){007}, 2.22(1){00.10}, 2.01(4){00.11}, 1.84(1){00.12}. Glycol-solvated: 26.80(100){001}, 13.21(33){002}, 9.02(9){003}, 6.66(2){004}, 5.30(7){005}, 4.48(3){006}, 3.82(1){007}, 3.33(20){008}, 2.97(3){009}, 2.66(1){00.10}, 2.46(1){00.11}, 2.22(1){00.12}, 2.04(1){00.13}, 1.91(2){00.14}. Optical data: none available. Chemical analytical data: Five sets of XRF data are given. One of these consists of: \( \text{SiO}_2 74.82, \text{Al}_2\text{O}_3 12.01, \text{TiO}_2 0.17, \text{Fe}_2\text{O}_3 7.66, \text{MgO} 1.03, \text{CaO} 0.17, \text{Na}_2\text{O} 1.03, \text{K}_2\text{O} 0.31, \text{MnO} 0.06, \text{P}_2\text{O}_5 0.02, \text{LOI} 3.01 \), Total 100.30 wt.%. Relationship to other species: It is made up of pyrophyllite-like and smectite-like units.

Name: After Dr. Brin Roberts, Birkbeck College, University of London, UK.

Comments: IMA No. 1997–040B. Descriptions of interstratified minerals lack many of the usual mineralogical data, but the minerals are considered valid species. The designation “RI” in the reference stands for “Reichweite Illite”.

**Calderonite**

**Pb\textsubscript{2}Fe\textsuperscript{3+}(VO\textsubscript{4})\textsubscript{2}(OH)**

**MONOCLINIC**

**Localities:** Las Colmenitas and Los Llanos mine, 2 km northwest of Santa Marta village (Lat. 38° 37'N, Long. 6° 36'E), Badajoz province, Spain. It also occurs at the La Muda mine, in Azuaga (Lat. 38° 20'20"N, Long. 5° 47'30"E), Badajoz province, Spain, at the Venus mine, Sierra Gorda, Argentina, and at the Nepomucene mine, Annaberg, Austria.

**Occurrence:** In the upper oxidation zone of the two Pb–Zn hydrothermal deposits. Associated minerals are: vanadinite and descloiizite. Other minerals not directly associated with calderonite are: wulfenite, mimetite, cerussite, beudantite, adamite, hemimorphite, smithsonite, chalcophanite, silver, quartz and Ca–Fe carbonates.

**General appearance:** Scattered clusters of idiomorphic prismatic crystals up to 1 mm long.

**Physical, chemical and crystallographic properties:**

- **Luster:** vitreous to resinous.
- **Diaphaneity:** semi-transparent to translucent.
- **Color:** deep orange to red brown.
- **Streak:** red orange.
- **Luminescence:** nonfluorescent.
- **Hardness:** between 3 and 4.
- **Tenacity:** not given.
- **Cleavage:** not given.
- **Fracture:** splintery.
- **Density:** not given, 6.08 g/cm\(^3\) (calc.) by the abstractor.
- **Cry stalllography:** Monoclinic, \(P2_1/m\), \(a = 7.647, b = 6.094, c = 8.900\) Å, \(\beta = 112.0^\circ\), \(V = 384.5\) Å\(^3\), \(Z = 2\), \(a:b:c = 1.2548:1:1.4605\). Morphology: no forms were listed, but the SEM photograph shows several forms. Twinning: none mentioned. X-ray powder-diffraction data: 4.893(43)(011), 4.166(34)(002), 3.401(21)(002), 3.242(100)(211), 3.058(25)(020), 2.980(48)(103), 2.746(48)(003), 2.449(20)(022).
- **Optical data:** Biaxial (+), indices of refraction not given (the mean index of refraction calculated by the abstractor from the Gladstone–Dale relationship is 2.25), \(2V\) (meas.) 86° given as \(2V_c\) which indicates biaxial (−), dispersion strong; pleochroism: X light greenish yellow, Y: brown, Z reddish brown; orientation not given.
- **Chemical analytical data:** Mean of twenty-one sets of electron-microprobe data (H\(_2\)O by TGA): PbO 61.80, CaO 0.03, BaO 0.32, CuO 0.67, ZnO 0.09, Al\(_2\)O\(_3\) 0.11, Fe\(_2\)O\(_3\) 10.12, Mn\(_2\)O\(_3\) <0.01, SiO\(_2\) 0.33, V\(_2\)O\(_5\) 23.86, As\(_2\)O\(_3\) 0.13, P\(_2\)O\(_5\) 0.57, H\(_2\)O 1.91, Total 99.94 wt.%. Empirical formula: \((\text{Pb}_{1.95}\text{Ba}_{0.01})_{2.96}\text{(Fe}^{3+}_{0.89}\text{Cu}_{0.06}\text{Al}_{0.02}\text{Zn}_{0.01})_{2.98}\text{(V}_{1.85}\text{P}_{0.06}\text{Si}_{0.01}\text{As}_{0.01})_{2.96}\text{O}_{7.51}(\text{OH})_{1.49}\). Ideally, Pb\(_2\)Fe\(_{3+}\)(VO\(_4\))\(_2\)(OH).

**Relationship to other species:** It is the Pb-, Fe\(_{3+}\)-, VO\(_4\)-dominant member of the brackebuschite group and, therefore, the Fe\(_{3+}\)-dominant analogue of brackebuschite and the Pb-dominant analogue of gamagarite.

**Name:** After Salvador Calderón (1852–1911), Professor of Geology of the Central University in Madrid and head of the Mineralogical section of the Natural Sciences Museum there.

**Comments:** IMA No. 2001–022.

Cattiite

**Locality**: Zhelezny mine, Kovdor Massif, Kola Peninsula, Russia.

**Occurrence**: In cavities in dolomite carbonatite. Associated minerals are: dolomite, bakhchisaraitsevite, nastrophite, magnetite, sjögrenite and carbonate-fluorapatite.

**General appearance**: Crystalline masses up to 1.5 cm.

**Physical, chemical and crystallographic properties**: Luster: vitreous, pearly on cleavages. Diaphaneity: transparent. Color: colorless. Streak: white. Luminescence: not observed. Hardness: 2. Tenacity: not mentioned. Cleavage: {001} perfect. Fracture: uneven. Density: 1.65 g/cm³ (meas.), 1.64 g/cm³ (calc.). Crystallography: Triclinic, $P\bar{1}$, $a$ 6.932, $b$ 6.925, $c$ 16.154 Å, $\alpha$ 82.21°, $\beta$ 89.70°, $\gamma$ 119.51°, V 666.3 Å³, Z = 1, $a:b:c = 1.0010:1:2.3327$. Morphology: {001}. Twinning: none mentioned. X-ray powder-diffraction data: 7.98(100)(002), 5.32(63)(003), 3.19(45)(1−14), 2.89(33)(202), 2.86(30)(222), 2.72(32)(115), 2.65(37)(006). Optical data: Biaxial (−), $\alpha$ 1.459, $\beta$ 1.470, $\gamma$ 1.470, $2V$ (meas.) 25°, $2V$ (calc.) 0°; dispersion $r < v$, weak; nonpleochroic; $X \wedge c = 80°$, $Y \wedge a = 10°$, $Z \wedge c = 90°$, optic axial plane close to (001). Chemical analytical data: A wet-chemical analysis of a 243.5 mg sample (H₂O by weight loss at 1000°C) gave: MgO 18.0, FeO 0.1, P₂O₅ 21.8, H₂O 60.8. Total 100.7 wt.%. Empirical formula: (Mg₂.92Fe₀.01)₂.₉₃(PO₄)₂.₀₁•2₂.₀₅H₂O. Relationship to other species: It is the natural -1A2 polytype of synthetic Mg₃(PO₄)₂•22H₂O.

**Name**: After Michele Catti (b. 1945), Professor of Physical Chemistry, University of Milano Bicocca, Italy, for his contributions to the crystal chemistry of hydrated oxysalts.

**Comments**: IMA No. 2000−032.

Čejkaite

\[ \text{Na}_4(\text{UO}_2)(\text{CO}_3)_3 \]

**Locality:** The Geschieber vein, Svornost mine, Jáchymov, northwestern Bohemia, Czech Republic.

**Occurrence:** An efflorescence on a calcite vein with disintegrated uraninite in a single specimen. Secondary associated minerals are andersonite and schröckingerite, but they are not in direct contact with Čejkaite.

**General appearance:** An earthy efflorescence consisting of crystals from 0.2 to 0.6 μm.

**Physical, chemical and crystallographic properties:**
- **Luster:** vitreous.
- **Diaphaneity:** not observed.
- **Color:** pale yellow to beige.
- **Streak:** light yellow.
- **Luminescence:** fluoresces weak yellow to yellow-green in short- and long-wave ultraviolet light.
- **Hardness:** could not be determined.
- **Tenacity:** could not be determined.
- **Fracture:** could not be determined.
- **Cleavage:** could not be determined.
- **Density:** 3.67 g/cm\(^3\) (meas.), 3.77 g/cm\(^3\) (calc.).
- **Crystallography:** Triclinic, \( \text{P}\overline{1} \) or \( \text{P}\overline{1} \), \( a = 9.291 \), \( b = 9.292 \), \( c = 12.895 \) Å, \( \alpha = 90.73^\circ \), \( \beta = 90.82^\circ \), \( \gamma = 120.00^\circ \), \( V = 963.7 \) Å\(^3\), \( Z = 4 \), \( a:b:c = 0.9999:1:1.3878 \). Morphology: no forms were identified, but individual crystallites display indistinct hexagonal morphology in TEM images. Twinning: none mentioned.
- **X-ray powder-diffraction data:** 8.022(92)(110,010,100), 5.080(57)(102,012), 5.024(60)(112,112), 4.967(68)(012,102), 4.639(100)(120,210,110), 3.221(63)(004), 2.681(60)(3-14,030,300).

**X-ray powder-diffraction data** could not be determined owing to the extremely small grain-size. The mean index of refraction derived from Gladstone–Dale calculations is 1.5825, which is consistent with the mean index of refraction measured for the trigonal polymorph of \( \text{Na}_4(\text{UO}_2)(\text{CO}_3)_3 \). **Chemical analytical data:** A combination of ICP–MS and thermal analysis (with CO\(_2\) by difference) gave: Na\(_2\)O 21.39, MgO 0.15, FeO 0.53, UO\(_3\) 53.93, CO\(_2\) (24.00), Total (100.00) wt.%. Empirical formula: \( (\text{Na}_{3.77}\text{Fe}_{0.04}\text{Mg}_{0.02})_{1.83}(\text{UO}_2)_{1.83}(\text{CO}_3)_{2.88} \). **Relationship to other species:** It is structurally similar to synthetic trigonal \( \text{Na}_4(\text{UO}_2)(\text{CO}_3)_3 \).

**Name:** After Jiří Čejka (b. 1929), former Director of the Museum of Natural History of the National Museum in Prague, in recognition of his numerous contributions to the crystal chemistry of uranium minerals.

**Comments:** IMA No. 1999–045.

Clinobarylite

BaBe$_2$Si$_2$O$_7$

**Locality:** Mount Yukspor, Khibina massif, Kola Peninsula, Russia.

**Occurrence:** In four alkaline pegmatite veins. Associated minerals are: natrolite, aegirine, microcline, catapleiite, fluorapatite, titanite, fluoroite, galena, sphalerite, strotianite, annite, astrophyllite, lorenzenite, labuntsovite-Mn, kuzmenkoite-Mn, cerite-(Ce), edingtonite, ilmenite and calcite.

**General appearance:** Platy to prismatic crystals (up to 20 \(\times\) 4 \(\times\) 1 mm) and radiating aggregates.

**Physical, chemical and crystallographic properties:**

- **Luster:** strong, vitreous.
- **Diaphaneity:** transparent.
- **Color:** colorless.
- **Streak:** white.
- **Luminescence:** nonfluorescent.
- **Hardness:** 6\(\frac{1}{2}\).
- **Tenacity:** brittle.
- **Cleavage:** \{100\} perfect, \{001\} and \{101\} less perfect.
- **Fracture:** uneven.
- **Density:** 3.97 g/cm$^3$ (meas.), 4.10 g/cm$^3$ (calc.).
- **Crystallography:** Monoclinic, \(Pm\alpha\), \(a\) 11.618, \(b\) 4.904, \(c\) 4.655 Å, \(\beta\) 89.94°, \(V\) 265.2 Å$^3$, \(Z\) = 2, \(a:b:c\) = 2.3691:1:0.9492.
- **Morphology:** \{100\}, \{010\}, \{201\}; less common forms are \{610\}, \{101\}, \{\overline{101}\}. Twinning: micro-twinning about \{010\}.
- **X-ray powder-diffraction data:** 3.389(84)(011), 3.249(45)(111,11\(\bar{1}\)), 3.043(40)(310), 2.926(55)(211,21\(\bar{1}\)), 2.458(100)(020), 2.335(48)(002).
- **Optical data:** Biaxial (+), \(\alpha\) 1.698, \(\beta\) 1.700, \(\gamma\) 1.705, 2\(V\)(meas.) 70°, 2\(V\)(calc.) 65°; dispersion not observed; nonpleochroic; \(X\) = \(a\) = 6°, \(Y\) = \(c\) 5.5°, \(Z\) = \(b\).
- **Chemical analytical data:** Mean of four sets of electron-microprobe data (BeO by atomic emission): BaO 47.66, BeO 14.90, SiO$_2$ 36.38, Total 98.94 wt.%. Empirical formula: Ba$_{1.03}$Be$_{1.97}$Si$_{2.00}$O$_{7.00}$.

**Name:** Reflects the relationship to barylite.

**Comments:** IMA No. 2002–015.

Eveslogite

(Ca,K,Na,Sr,Ba)$_{48}$[(Ti,Nb,Fe,Mn)$_{12}$\(\text{OH}\)\(_{12}\)Si\(_{48}\)O\(_{144}\)](F,OH,Cl)\(_{14}\)

**Locality**: Mount Eveslogchorr, Khibina alkaline massif, Kola Peninsula, Russia.

**Occurrence**: As a monomineralic veinlet cross-cutting poikilitic nepheline syenite. Associated minerals are: nepheline, potassium feldspar, biotite, shcherbakovite, astrophyllite, fluorapatite.

**General appearance**: Subparallel intergrowths of fine-fibrous crystals (up to 0.005 mm thick and 5 cm long); aggregates 10 to 15 cm across.

**Physical, chemical and crystallographic properties**:
- **Luster**: silky.
- **Diaphaneity**: translucent.
- **Color**: light brown, yellow.
- **Streak**: white.
- **Luminescence**: nonfluorescent.
- **Hardness**: 5.
- **Tenacity**: brittle.
- **Cleavage**: \{001\} perfect (mica-like), \{010\} good. Fracture: splintery or fibrous.
- **Density**: 2.85 g/cm\(^3\) (meas.), 2.91 g/cm\(^3\) (calc.).
- **Crystallography**: Monoclinic, \(P2_1/m\) (?), \(a\) 14.069, \(b\) 24.937, \(c\) 44.31 Å, \(\gamma\) 95.02°, \(V\) 15,486 Å\(^3\), \(Z\) = 4, \(a:b:c\) = 0.5642:1:1.7769.
- **Morphology**: \{001\} flattened on \{001\} and elongate along \[100\]. Twinning: none observed.
- **Optical data**: Biaxial (-), \(\alpha\) 1.631, \(\beta\) 1.641, \(\gamma\) 1.647, 2\(V\)(meas.) 82°, 2\(V\)(calc.) 75°; dispersion not observed; pleochroism marked, \(X\) colorless, \(Y\) and \(Z\) yellow, \(Z\approx X\approx a, Y\approx c, Z\approx b\) in obtuse angle \(\beta\), \(Z=b\) (the authors give \(X\approx a, Y= c, Z\approx b\approx 5°\) in obtuse angle \(\gamma\), but this is not possible in a monoclinic crystal).
- **Chemical analytical data**: A wet-chemical analysis gave: Na\(_2\)O 4.59, K\(_2\)O 8.53, Rb\(_2\)O 0.20, CaO 18.60, SrO 2.75, BaO 2.84, MnO 1.00, FeO 0.88, Al\(_2\)O\(_3\) 0.32, Fe\(_2\)O\(_3\) 0.23, Ti\(_2\)O\(_3\) 6.52, Zr\(_2\)O\(_2\) 0.35, Nb\(_2\)O\(_5\) 6.56, Ta\(_2\)O\(_5\) 0.25, SiO\(_2\) 41.96, H\(_2\)O 2.85, F 2.72, Cl 0.42, sum 101.57, less O = F + Cl 1.24, Total 100.33 wt.%. Empirical formula: (Ca\(_{32.46}\)K\(_{12.27}\)Na\(_{10.03}\)Sr\(_{1.80}\)Ba\(_{1.25}\))\(_{48}\) [Ti\(_{5.53}\)Nb\(_{3.34}\)Mn\(_{0.95}\)Fe\(_{2+}\)\(_{0.81}\)Fe\(_{3+}\)\(_{0.20}\)Zr\(_{0.19}\)Rb\(_{0.14}\)Tl\(_{0.08}\)]\(_{11.26}\) (OH)\(_{12.00}\)(Si\(_{47.30}\)Al\(_{1.43}\))\(_{34.73}\)(O\(_{138.08}\)(OH)\(_{9.22}\)F\(_{0.70}\)Cl\(_{0.80}\))\(_{158.00}\).

**Relationship to other species**: It is a mixed-layered titanosilicate with an astrophyllite-like structure.

**Name**: After the locality.

**Comments**: IMA No. 2001–023A.

Ferrohögbomite-2N2S

\((\text{Fe}^{2+}\text{ZnMgAl})\Sigma_6(\text{Al}_{14}\text{Fe}^{3+}\text{Ti}^{4+})\Sigma_16\text{O}_30(\text{OH})_2\)

**Locality:** Ain Taïba, at the northwestern edge of Grand Erg Oriental, Sahara Desert, Algeria (Lat. 30°16.44'N, Long. 5°48.94'E, 227 m above sea level). The mineral also has been found at the following localities: Lusaka, Zambia; Strangways Range, central Australia; Benson mine, Adirondack Mountains, New York, USA; Prince Olav Coast, eastern Antarctica.

**Occurrence:** At the type locality (Aïn Taïba), the mineral was found in an isolated rock. Associated minerals are: hematite, ilmenite, pseudorutile, magnetite and hercynite.

**General appearance:** Euhedral grains up to 0.3 mm along grain boundaries and in fissures within ilmenite, pseudorutile and hematite. Some grains are closely associated with hercynite.

**Physical, chemical and crystallographic properties:**
- **Luster:** adamantine.
- **Diaphaneity:** translucent.
- **Color:** reddish brown.
- **Streak:** brownish.
- **Luminescence:** nonfluorescent.
- **Hardness:** 6 to 7.
- **Tenacity:** brittle.
- **Cleavage:** \{001\} pronounced.
- **Fracture:** conchoidal.
- **Density:** could not be measured because the mineral is intergrown with other minerals, 4.04 g/cm³ (calc.).
- **Crystallography:** Hexagonal, \(P\bar{6}_3\text{mc}\), \(a = 5.712\), \(c = 18.317\) Å, \(V = 517.6\) Å³, \(Z = 1\), \(c:a = 3.2068\). Morphology: no forms were observed. Twinning: by merohedry with the inversion center as the twin operation. **X-ray powder-diffraction data:** 2.867(38)(110), 2.608(66)(016), 2.433(91)(114), 2.058(34)(025), 1.601(60)(126,003), 1.557(35)(034), 1.478(78)(0.2.10), 1.434(100)(220). See Comments. **Optical data:** Uniaxial (-), indices of refraction could not be measured (material of similar composition has \(\omega = 1.852, \epsilon = 1.827\)), pleochroic from orange-brown to yellow. **Chemical analytical data:** Mean of 32 sets of electron-microprobe data (\(\text{Fe}_2\text{O}_3\) and \(\text{FeO}\) calculated from total \(\text{Fe}\) to give charge balance; \(\text{H}_2\text{O}\) calculated to give 2\(\text{H}\)): \(\text{MgO} 3.27, \text{CaO} 0.02, \text{MnO} 0.25, \text{FeO} 16.35, \text{NiO} 0.05, \text{ZnO} 5.88, \text{Al}_2\text{O}_3 59.28, \text{Cr}_2\text{O}_3 0.09, \text{Fe}_2\text{O}_3 8.05, \text{Ga}_2\text{O}_3 0.25, \text{SiO}_2 0.04, \text{TiO}_2 5.04, \text{SnO}_2 0.38, \text{H}_2\text{O} (1.42), \text{Total} (100.37)\) wt.%. Empirical formula: \((\text{Fe}^{2+}\text{Zn}\text{Mg}_{0.05}\text{Sn}_{0.03}\text{Ni}_{0.01}\text{Al}_{0.06})\Sigma_6\text{O}_{28.98}^{2.02}\text{OH}_{2.02}\). **Relationship to other species:** It is the \(\text{Fe}^{2+}\)-dominant, -2N2S polysome of the högbomite group.

**Name:** Given in compliance with the approved nomenclature of the högbomite group. This mineral formerly was known as “högbomite-8H”.

**Comments:** IMA No. 2001–048. The X-ray powder-diffraction data were calculated and compared very well with data measured for material of similar composition.

### Ferrosaponite

\[
\text{Ca}_{0.3}\left(\text{Fe}^{2+},\text{Mg,Fe}^{3+}\right)_{3}\left(\text{Si,Al}\right)_{4}\text{O}_{10}(\text{OH})_{2}\cdot4\text{H}_{2}\text{O}
\]

**Locality:** Levoberezhye Iceland spar deposit, Nizhnyaya Tunguska River, Evenkiya, Siberia, Russia.

**Occurrence:** A hydrothermal mineral associated with pillow basalt lavas. Associated minerals are: calcite, pyrite, "chalcedony", mordenite, heulandite-Ca and stilbite-Ca.

**General appearance:** Spherulites up to 2 mm in diameter in transparent calcite.

**Physical, chemical and crystallographic properties:**
- **Luster:** vitreous.
- **Diaphaneity:** translucent.
- **Color:** dark green.
- **Streak:** green.
- **Magnetic properties:** nonmagnetic.
- **Hardness:** 2.
- **Tenacity:** sectile.
- **Cleavage:** {001} perfect.
- **Fracture:** uneven.
- **Density:** 2.49 g/cm\(^3\) (meas.), 2.39 g/cm\(^3\) (calc.) [see Comments].
- **Crystallography:** Monoclinic, space group unknown but probably a \(P\)-cell [see Comments]. \(a\) 5.365, \(b\) 9.337, \(c\) 14.65 Å; \(\beta\) 94.9°, \(V\) 731 Å\(^3\), \(Z\) = 2, \(a:b:c = 0.5746:1:1.5690\).
- **X-ray powder-diffraction data:** 7.37(90)(002), 4.72(90)(020), 3.80(80)(112), 3.03(100)(031), 2.585(90)(201), 2.429(90)(006), 1.549(90)(060).
- **Optical data:** Biaxial (-), \(\alpha\) 1.282 [see Comments], \(\beta\) 1.641, \(\gamma\) 1.642, 2\(V\)(meas.) 5°, dispersion not observed; pleochroic brown, \(Z \approx Y; X \approx c\).

**Chemical analytical data:** Mean of five sets of electron-microprobe data (with \(H_2O\) by TGA): Na\(_2\)O 0.21, K\(_2\)O 0.07, MgO 6.62, CaO 3.31, FeO 21.23, Al\(_2\)O\(_3\) 9.95, Fe\(_2\)O\(_3\) 8.78, SiO\(_2\) 33.15, H\(_2\)O 17.92, Total 101.24 wt.%. Empirical formula: \((\text{Ca}_{0.31}\text{Na}_{0.04}\text{K}_{0.01})\Sigma_{0.36}\left(\text{Fe}^{2+}_{1.34}\text{Mg}_{0.85}\text{Fe}^{3+}_{0.45}\right)\Sigma_{2.84}\left(\text{Si}_{2.87}\text{Al}_{1.01}\text{Fe}^{3+}_{0.12}\right)\Sigma_{4.00}\text{O}_{10}(\text{OH})_{2.33}\cdot4\text{H}_{2}\text{O}.

**Name:** Reflects the relationship to saponite.

**Comments:** IMA No. 2002–028. There are some inconsistencies in this description: (1) the authors give the calculated density as 2.435 g/cm\(^3\), but using the given unit-cell and chemical data, a value of 2.39 g/cm\(^3\) is calculated; (2) the authors state that the unit cell probably is \(P\)-centered, but by analogy with saponite, it should be \(C\)-centered; (3) the \(\alpha\) index of refraction is given as 1.448, and stated to have been calculated by the Gladstone–Dale relationship, but no explanation of how this was done is given; the value \(\alpha\) 1.282 was calculated here from \(\beta\), \(\gamma\) and 2\(V\).

Chukanov, N.V., Pekov, I.V., Zadov, A.E., Chukanova, V.N. & Mokkel, S. (2003): Ferrosaponite \(\text{Ca}_{0.3}\left(\text{Fe}^{2+},\text{Mg,Fe}^{3+}\right)_{3}\left(\text{Si,Al}\right)_{4}\text{O}_{10}(\text{OH})\cdot4\text{H}_{2}\text{O},\) the new trioctahedral smectite. Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva 132(2), 68-74 (in Russ.).
Galgenbergite-(Ce)

Ca(REE)$_2$(CO$_3$)$_4$$\cdot$H$_2$O

**Locality:** The railroad tunnel Galgenberg, Jassing, between Leoben and St. Michael, Styria, Austria (Lat. 47° 20'48"N, Long. 15° 2'19"E, altitude 570 m above sea level).

**Occurrence:** In small fissures of an albite–chlorite schist. Associated minerals are: calcite, siderite, pyrite and kaolinite.

**General appearance:** Rosette aggregates about 1 mm in diameter composed of idiomorphic crystals about 0.6 mm long.

**Physical, chemical and crystallographic properties:**
- **Luster:** vitreous.
- **Diaphaneity:** transparent to translucent.
- **Color:** colorless to white.
- **Streak:** white.
- **Luminescence:** nonfluorescent.
- **Hardness:** not determined owing to the small size of crystals.
- **Tenacity:** brittle.
- **Cleavage:** {001} perfect.
- **Fracture:** splintery.
- **Density:** could not be measured, 3.99 g/cm$^3$ (calc.).
- **Crystallography:** Triclinic, $P\bar{1}$, $a$ 6.388, $b$ 6.386, $c$ 12.388 Å, $\alpha$ 96.54, $\beta$ 100.85, $\gamma$ 100.51°, $V$ 482.2 Å$^3$, $Z$ = 2, $a:b:c$ = 1.0003:1:1.9399. Morphology: {001}, {101}, {010}, tabular on {001}. Twinning: none observed. **X-ray powder-diffraction data:** 5.901(59)(011), 5.049(100)(101), 4.695(38)(012), 4.468(38)(111), 3.899(49)(112), 3.229(33)(113), 3.125(45)(021), 3.0051(65)(004). **Optical data:** Biaxial (--), $\alpha$ 1.635, $\beta$ 1.725, $\gamma$ 1.750, 2V(calc.) 53°; dispersion not measurable; nonpleochroic; $X$ $\wedge$ $a$ = 119°, $Y$ $\wedge$ $a$ = 46°, $Z$ $\wedge$ $a$ = 121°; $X$ $\wedge$ $b$ = 62°, $Y$ $\wedge$ $b$ = 120°, $Z$ $\wedge$ $b$ = 137°; $X$ $\wedge$ $c$ = 37°, $Y$ $\wedge$ $c$ = 59°, $Z$ $\wedge$ $c$ = 73°. **Chemical analytical data:** Mean of six sets of electron-microprobe data (H$_2$O and CO$_2$ calculated here to give 1 H$_2$O and 4 CO$_3$ as indicated by the crystal-structure determination): CaO 9.22, Ce$_2$O$_3$ 28.11, La$_2$O$_3$ 11.36, Nd$_2$O$_3$ 11.52, Pr$_2$O$_3$ 3.38, CO$_2$ (29.13), H$_2$O (2.98). Total (95.70) wt.% Empirical formula: Ca$_{0.95}$Ce$_{1.04}$La$_{0.42}$Nd$_{0.41}$Pr$_{0.12}$O$_{21.99}$ (CO$_3$)$_{4.00}$$\cdot$1.00H$_2$O. **Relationship to other species:** It is chemically similar to various Ca–REE-carbonates, but the structure is different.

**Name:** Recalls the locality.

**Comments:** IMA No. 1997–036. Only an extended abstract of this description has been published (see below), but Prof. Dr. Franz Walter (Universität Graz) kindly supplied additional information. The crystal structure has been solved.


**Glagolevite**

\[ \text{NaMg}_6[\text{Si}_3\text{AlO}_{10}](\text{OH},\text{O})_8\cdot\text{H}_2\text{O} \]

---

**Locality:** Kovdor phlogopite quarry, Kovdor massif, Kola Peninsula, Russia.

**Occurrence:** Associated minerals are: vesuvianite, pectolite, monticellite, diopside, phlogopite, andradite, apatite, magnetite, olivine, calcite.

**General appearance:** Massive aggregates (up to several cm); platy grains 1 to 15 mm.

**Physical, chemical and crystallographic properties:**

- **Luster:** vitreous.
- **Diaphaneity:** transparent.
- **Color:** colorless.
- **Streak:** white.
- **Luminescence:** nonfluorescent.
- **Hardness:** 3 to 5.
- **Tenacity:** sectile.
- **Cleavage:** \{001\} perfect.
- **Fracture:** uneven.
- **Density:** 2.66 g/cm\(^3\) (meas.), 2.73 g/cm\(^3\) (calc.).

**Crystallography:** Triclinic, \(C_1\), \(a = 5.354\), \(b = 9.263\), \(c = 14.653\) Å, \(\alpha = 89.86\), \(\beta = 96.84\), \(\gamma = 90.03\), \(V = 721.5\) Å\(^3\), \(Z = 2\), \(a:b:c = 0.5780:1:1.5819\). Morphology: \{001\}, habit tabular on \{001\}. Twinning: none observed.

**X-ray powder-diffraction data:**


**Optical data:** Biaxial (+), \(\alpha = 1.569\), \(\beta (\text{calc.)} = 1.569\), \(\gamma = 1.571\), 2\(V\) (meas.) 17°; dispersion not observed; nonpleochroic; \(Z = c\).

**Chemical analytical data:** Mean of four sets of electron-microprobe data (H\(_2\)O by TGA): Na\(_2\)O 3.94, MgO 37.23, MnO 0.11, FeO 0.38, Al\(_2\)O\(_3\) 13.36, SiO\(_2\) 29.24, H\(_2\)O 14.5. Total 98.76 wt.%. Empirical formula: Na\(_0.76\) (Mg\(_{5.55}\)Al\(_{0.45}\)Fe\(_{0.03}\)Mn\(_{0.01}\))\(_2\)\(_6\)\(_{0.08}\) [(Si\(_{2.92}\)Al\(_{1.08}\))\(_4\)\(_{0.00}\)O\(_{10.00}\)] [(OH)]\(_7.67\)O\(_{0.33}\)\(_2\)E\(_{0.00}\)\(_1\)H\(_{2}\)O. 1.00H\(_2\)O.

**Relationship to other species:** It is chemically related to clinochlore, but is a new structure-type.

**Name:** After A.A. Glagolev (1927–1993), Russian petrographer who worked at Kovdor for many years.

**Comments:** IMA No. 2001–064.

Graulichite-(Ce)

CeFe$^{3+3}$(AsO$_4$)$_2$(OH)$_6$

**Locality**: Hourt, 2 km north of Vielsalm, in the southeastern border region of the Stavelot Massif, Ardennes, Belgium.

**Occurrence**: In quartzites associated minerals with: arsenopyrite, scorodite, mimetite, pharmacosiderite, barium-pharmacosiderite and goethite.

**General appearance**: Spherical aggregates 80 to 150 μm in diameter, made up of rhombohedral crystals 50 to 80 μm across.

**Physical, chemical and crystallographic properties**:
- **Luster**: resinous.
- **Diaphaneity**: transparent.
- **Color**: light green to brownish.
- **Streak**: not given.
- **Luminescence**: nonfluorescent.
- **Hardness**: not given.
- **Tenacity**: not given.
- **Cleavage**: none.
- **Fracture**: irregular.
- **Density**: greater than 3.9 g/cm$^3$ (meas.), 4.40 g/cm$^3$ (calc.).
- **Crystallography**: Trigonal, $R\bar{3}m$, $a$ 7.260, $c$ 16.77 Å, $V$ 765.5 Å$^3$, $Z$ = 3, $c/a$ = 2.3099.
- **Morphology**: {102}, {101}.
- **Twinning**: none mentioned.
- **Optical data**: Uniaxial (−), mean $n$ close to 1.97, pleochroism light green to yellowish.
- **Chemical analytical data**: Mean of 33 sets of electron-microprobe data (with H$_2$O calculated to give OH + H$_2$O = 6): CaO 0.03, SrO 0.24, BaO 3.95, PbO 0.07, Al$_2$O$_3$ 3.09, Fe$_2$O$_3$ 3.05, La$_2$O$_3$ 2.26, Ce$_2$O$_3$ 15.73, Nd$_2$O$_3$ 2.08, SiO$_2$ 0.03, P$_2$O$_5$ 0.03, As$_2$O$_5$ 3.20, H$_2$O (8.37), Total (97.79) wt.%. Empirical formula: (Ce$_{0.66}$Ba$_{0.18}$La$_{0.10}$Nd$_{0.09}$Sr$_{0.02}$)$_2$Fe$_{3.63}$Al$_{0.42}$O$_{8.07}$[(As$_{1.88}$S$_{0.01}$)$_2$O$_{8.00}$](OH)$_{5.62}$[(H$_2$O)$_{0.40}$]$_{5.62}$.
- **Relationship to other species**: It is a member of the crandallite group and the Fe$^{3+}$-dominant analogue of arsenoflorencite-(Ce), CeAl$_2$(AsO$_4$)$_2$(OH)$_6$.

**Name**: After Jean-Marie Graulich (1920–2001), mining engineer and honorary director of the Geological Survey of Belgium, in recognition of his contributions to the knowledge of the geology of the Stavelot Massif.

**Comments**: IMA No. 2002–001.

**Greifensteinite**

\[
\text{Ca}_2\text{Be}_4(\text{Fe}^{2+}\text{Mn})_5(\text{PO}_4)_6(\text{OH})_4\cdot 6\text{H}_2\text{O}
\]

**Locality:** Greifenstein, Saxony, Germany.

**Occurrence:** In a Li-rich granitic pegmatite. Associated minerals are: albite, K-feldspar, roscherite, viitaniemiite, childrenite, quartz, apatite, herderite, elbaite and montmorillonite.

**General appearance:** Radiating aggregates up to 5 mm.

**Physical, chemical and crystallographic properties:**
- **Luster:** vitreous.
- **Diaphaneity:** transparent.
- **Color:** dark olive green.
- **Streak:** white.
- **Luminescence:** nonfluorescent.
- **Hardness:** 4½.
- **Tenacity:** brittle.
- **Cleavage:** {100} good.
- **Fracture:** uneven.
- **Density:** 2.93 g/cm\(^3\) (meas.), 2.93 g/cm\(^3\) (calc.).
- **Crystallography:** Monoclinic, \(C_2/c\), \(a = 15.903\), \(b = 11.885\), \(c = 6.677\) Å, \(\beta = 94.68^\circ\), \(V = 1257.8\) Å\(^3\), \(Z = 2\).
- **Morphology:** {100} and {110}, habit prismatic.
- **Twinning:** none observed.
- **X-ray powder-diffraction data:**
  - \(2.982(7)(202)\), \(2.783(8)(240)\), \(2.638(7)(600)\).
- **Optical data:** Biaxial (–), \(\alpha = 1.624\), \(\beta = 1.634\), \(\gamma = 1.638\), \(2\upsilon(\text{meas.}) = 80^\circ\), \(2\upsilon(\text{calc.}) = 64^\circ\).
- **Dispersion not observed; pleochroic, X light blue-green, Y light-green, Z brown to green; \(X = b\).**

**Chemical analytical data:** Mean of five sets of electron-microprobe data (H\(_2\)O by TGA): BeO 9.24, MgO 0.34, CaO 9.98, MnO 5.56, FeO 22.42, Al\(_2\)O\(_3\) 1.05, P\(_2\)O\(_5\) 38.36, H\(_2\)O 13.6, Total 100.55 wt.%. Empirical formula: \(\text{Ca}_2\text{Be}_4(\text{Fe}^{2+}\text{Mn})_5(\text{PO}_4)_6(\text{OH})_4\cdot 6\text{H}_2\text{O}\). **Relationship to other species:** It is the Fe\(^{2+}\)-dominant member of the roscherite group.

**Name:** Recalls the type locality.

**Comments:** IMA No. 2001–044.


Rastsvetaeva, R.K., Gurbanova, O.A. & Chukanov, N.V. (2002): Crystal structure of greifensteinite, \(\text{Ca}_2\text{Be}_4(\text{Fe}^{2+}\text{Mn})_5(\text{PO}_4)_6(\text{OH})_4\cdot 6\text{H}_2\text{O}\). *Doklady Chemistry* 383, 78–81.
Magnesiostaurolite

\[ 4\text{Mg}_4\text{Al}_{16}(\text{Al}_2\text{Si}_8\text{O}_{40})(\text{OH})_2\text{O}_6 \]

**Locality**: The Dora–Maira massif, especially in the Vallone di Gilba, Val Varaita, Western Alps, Italy.

**Occurrence**: As inclusions in pyrope megablasts from coesite-bearing metamorphic terrane. Associated minerals are: pyrope, talc, clinochlore, kyanite, rutile, magnesiodumortierite, corundum, magnesiochloritoid, ellenbergerite, chlorite.

**General appearance**: Anhedral isolated grains from a few tens to 250 μm across.


**Crystallography**: Monoclinic, \( C2/m \), \( a = 7.8706 \), \( b = 16.5411 \), \( c = 5.6323 \) Å, \( \beta = 90.007^\circ \), \( V = 733.3 \) Å³, \( Z = 1 \), \( a:b:c = 0.4758:1:0.3405 \). Morphology: no forms were mentioned. Twinning: none, but a "tweed" texture was observed between crossed nicols. *X-ray powder-diffraction data*: 4.139(23.6)(040), 3.516(21.6)(131), 3.001(20.3)(221), 2.678(38.0)(151), 2.390(50.4)(132), 2.370(32.8)(330), 2.356(24.0)(311), 1.968(100.0)(062), 1.511(23.3)(192), 1.407(23.0)(004), 1.391(81.8)(246), 1.377(21.8)(012). *Optical data*: Biaxial (sign unknown), mean \( n = 1.709 \), 2V(meas.) close to 90°; nonpleochroic; orientation unknown. *Chemical analytical data*: Mean of three sets of electron-microprobe data: Li₂O 0.90, MgO 7.77, FeO 0.72, ZnO 0.10, Al₂O₃ 57.45, SiO₂ 30.66, TiO₂ 0.18, H₂O 2.30, Total 100.08 wt.%. Empirical formula: \[ \square_{3.12}\text{Mg}_{0.72}\text{Fe}_{0.16}\]\[4.00(\text{Mg}_{1.85}\text{Li}_{0.02}\text{Zn}_{1.19})\]\[4.00(\text{Al}_{15.96}\text{Ti}_{0.00})\]\[16.00(\text{Al}_{1.58}\text{Mg}_{0.45}\]\[1.97)\]\[24.00(\text{Si}_{7.96}\text{Al}_{0.04})\]\[28.04\text{O}_{40.04}(\text{OH})_{1.98}\text{O}_{0.02}\] 8.00. *Relationship to other species*: It is the Mg-dominant analogue of staurolite and zincostaurolite.

**Name**: Recalls the relationship to staurolite.

**Comments**: IMA No. 1992–035.

Magnesiotantalite

\[(\text{Mg,Fe})(\text{Ta,Nb})_2\text{O}_6\]

**Locality:** Lipovka pegmatite field, Rezh district, Central Urals, Russia.

**Occurrence:** Intergrowths of magnesiotantalite, ferrotantalite, ferrocolumbite and uranium-bearing microlite form rims on manganotantalite crystals in andesine–calcite nests in a deeply desilicated granite pegmatite that cross-cuts serpentine near its contact with marble. Other associated minerals are: dravite–uvite series, chrysoberyl, phlogopite, magnesiohornblende–edenite series, cordierite, phenakite, clinohore, among others.

**General appearance:** Flattened irregular grains up to 0.4 mm and segregations up to 0.7 mm.

**Physical, chemical and crystallographic properties:**

- **Luster:** Semimetallic to metallic.
- **Diaphaneity:** Opalescent.
- **Color:** Black.
- **Streak:** Brown-red.
- **Hardness:** VHN50 489 kg/mm², Mohs 5½.
- **Tenacity:** Brittle.
- **Cleavage:** Not observed.
- **Fracture:** Uneven.
- **Density:** 6.7 g/cm³ (meas.), 6.79 g/cm³ (calc.).
- **Crystallography:** Orthorhombic, \(Pbcn\), \(a = 14.335\), \(b = 5.735\), \(c = 5.058\) Å, \(V = 415.8\) Å³, \(Z = 4\). Morphology: no forms were observed, flattened on \(\{010\}\). Twinning: none observed. **X-ray powder-diffraction data:**

\[
\begin{align*}
\text{(3.67(60)(310,111), 2.96(100)(311), 1.774(60)(330), 1.746(50)(602), 1.728(70)(621), 1.545(50)(910), 1.462(90)(911,332).} \\
\text{Optical data: In reflected light, light gray, very weak anisotropism, very weak bireflectance, nonpleochroic. R max., R min.:} \\
(15.20, 14.02) \quad 400 \text{ nm} \quad (15.18, 13.69) \quad 410 \text{ nm} \quad (15.05, 13.49) \quad 420 \text{ nm} \\
(14.79, 13.27) \quad 430 \text{ nm} \quad (14.53, 12.95) \quad 440 \text{ nm} \quad (14.28, 12.76) \quad 450 \text{ nm} \\
(13.97, 12.82) \quad 460 \text{ nm} \quad (13.75, 12.95) \quad 470 \text{ nm} \quad (13.58, 13.05) \quad 480 \text{ nm} \\
(13.44, 13.13) \quad 490 \text{ nm} \quad (13.33, 13.20) \quad 500 \text{ nm} \quad (13.25, 13.22) \quad 510 \text{ nm} \\
(13.23, 13.19) \quad 520 \text{ nm} \quad (13.25, 13.18) \quad 530 \text{ nm} \quad (13.32, 13.20) \quad 540 \text{ nm} \\
(13.41, 13.19) \quad 546 \text{ nm} \quad (13.47, 13.28) \quad 550 \text{ nm} \quad (13.67, 13.45) \quad 560 \text{ nm} \\
(13.94, 13.67) \quad 570 \text{ nm} \quad (14.25, 13.94) \quad 580 \text{ nm} \quad (14.57, 14.24) \quad 589 \text{ nm} \\
(14.58, 14.25) \quad 590 \text{ nm} \quad (14.90, 14.58) \quad 600 \text{ nm} \quad (15.18, 14.90) \quad 610 \text{ nm} \\
(15.41, 15.16) \quad 620 \text{ nm} \quad (15.56, 15.32) \quad 630 \text{ nm} \quad (15.61, 15.31) \quad 640 \text{ nm} \\
(15.55, 15.15) \quad 650 \text{ nm} \quad (15.41, 14.83) \quad 660 \text{ nm} \quad (15.22, 14.48) \quad 670 \text{ nm} \\
(15.00, 14.12) \quad 680 \text{ nm} \quad (14.88, 13.93) \quad 690 \text{ nm} \quad (14.76, 13.76) \quad 700 \text{ nm}
\end{align*}
\]

**Chemical analytical data:** Mean of five sets of electron-microprobe data: MgO 5.27, MnO 0.82, FeO 6.71, TiO₂ 0.38, Nb₂O₅ 24.19, Ta₂O₅ 61.86, Total 99.23 wt.%. Empirical formula: \((\text{Mg}_{0.56}\text{Fe}_{0.40}\text{Mn}_{0.05})\text{Ta}_{1.20}\text{Nb}_{0.78}\text{O}_{6}\). **Relationship to other species:** It is the Mg- and Ta-dominant member of the columbite group.

**Name:** Recalls the relationship to ferrotantalite and manganotantalite.

**Comments:** IMA No. 2002–018.

**Pekov, I.V., Yakubovich, O.V., Shcherbachev, D.K. & Kononkova, N.N. (2003):** Magnesiotantalite, \((\text{Mg,Fe})(\text{Ta,Nb})_2\text{O}_6\), the new columbite–tantalite group mineral from desilicated granite pegmatites of Lipovka (the central Urals) and its genesis. Zapiski Vserossiyskogo Mineralogicheskogo Obschestva 132(2), 49–59 (in Russ.).
**Marécottite**

\[ \text{Mg}_3(\text{H}_2\text{O})_{18}[\text{(UO}_2\text{)}_4\text{O}_3(\text{OH})(\text{SO}_4)_2](\text{H}_2\text{O})_{10} ] \]

**Locality**: La Creusaz uranium prospect near the village of Les Marécottes, Canton Valais, Western Alps, Switzerland.

**Occurrence**: In hydrothermal breccia veins. Associated minerals are: uraninite, gypsum, rabejacite, johannite and some other new uranium species.

**General appearance**: Diamond-shaped platelets up to 500 μm long grouped into rosettes.

**Physical, chemical and crystallographic properties**: **Luster**: vitreous. **Diaphaneity**: transparent. **Color**: yellow-orange. **Streak**: white. **Luminescence**: nonfluorescent. **Hardness**: about 3. **Tenacity**: very brittle. **Cleavage**: \{011\} perfect. **Fracture**: not given. **Density**: the mineral sinks in Clerici solution with a density of 4.03 g/cm³, 3.86 g/cm³ (calc.). **Crystallography**: Triclinic, \( P\bar{1} \), \( a = 10.815, b = 11.249, c = 13.851 \text{ Å}, \alpha = 66.224, \beta = 72.412, \gamma = 69.955^\circ \), \( V = 1422.1 \text{ Å}^3, Z = 1 \), \( a:b:c = 0.9614:1:1.2313 \). **Morphology**: \{011\} is the prominent form. **Twinning**: results in two twinned individuals with the composition plane corresponding to the long axis of the crystal and perpendicular to \{011\}. **X-ray powder-diffraction data**: 9.46(100)(011), 8.63(20)(101), 4.73(80)(022), 3.44(80)(013, 310), 3.39(70)(321, 022), 2.88(30)(303) and several other spacings with intensity 20. **Optical data**: Biaxial (sign not given), the indices of refraction measured in the (011) face range from 1.735 to 1.750, pleochroism fair from pale-yellow to orange-yellow in the (011) face. **Chemical analytical data**: Mean of eight sets of electron-microprobe data (with H₂O calculated): MgO 2.03, MnO 1.15, SO₃ 8.95, UO₃ 66.36, H₂O (14.73), Total (93.22) wt.%. **Empirical formula**: \( (\text{Mg}_{1.79\text{Mn}_{0.58}})_{2.37}(\text{UO}_2)_{8.24}(\text{SO}_4)_{3.37}(\text{OH})_{2.00} \text{O}_{3.64}•28.02\text{H}_2\text{O} \). **Relationship to other species**: It is related to magnesium-zippeite.

**Name**: Recalls the locality.

**Comments**: IMA No. 2001–056. The paper gives the species name without an acute accent on the first “e”; it has been corrected here.

Nikischerite

\[ \text{NaFe}^{2+}6\text{Al}_3\text{(SO}_4)_2\text{(OH)}_{18}\cdot 12\text{H}_2\text{O} \]

**Locality:** Huanuni tin mine, about 50 km southeast of Oruro City, Dalence Province, Oruro Department, Bolivia.

**Occurrence:** Nikischerite does not occur in the cassiterite-bearing veins themselves, but rather in a later, low-temperature paragenesis filling fault zones that cut across the cassiterite veins. Associated minerals are: pyrite, pyrrhotite, siderite and cronstedtite in a brownish clay matrix.

**General appearance:** Small micaceous plates (up to 4 mm) forming isolated radiating balls comprised of stacked plates and aggregates up to almost 1 cm across. A second occurrence, found in the early 1990s, consists of dull, tabular aggregates on vivianite crystals.

**Physical, chemical and crystallographic properties:**
- **Luster:** dull to greasy.
- **Diaphaneity:** transparent to translucent.
- **Color:** Georgian green (RHS #139B), darker at the edges of aggregates and approaches grayish white at the cores.
- **Streak:** pale grayish green.
- **Luminescence:** nonfluorescent.
- **Hardness:** 2.
- **Tenacity:** brittle.
- **Cleavage:** {001} perfect.
- **Fracture:** irregular.
- **Density:** 2.33 g/cm³ (meas.), 2.34 g/cm³ (calc.).
- **Crystallography:** Trigonal, \( R\bar{3} \), \( a = 9.352 \), \( c = 33.08 \) Å, \( V = 2505 \) Å³, \( Z = 3 \), \( c:a = 3.5372 \). Morphology: \{001\}. Twinning: none observed.
- **X-ray powder-diffraction data:** 10.980(100)(003), 5.539(60)(006), 4.311(20)(113), 3.674(50)(009), 2.624(25)(033), 2.425(30)(036), 2.176(20)(039), 1.932(30)(0.3.12).
- **Optical data:** Uniaxial (-), \( \omega = 1.560, e \) could not be determined, nonpleochroic.

**Chemical analytical data:** Mean of an unspecified number of sets of electron-microprobe data (with \( \text{H}_2\text{O} \) calculated to give 42 H): \( \text{Na}_2\text{O} 2.43, \text{FeO} 43.59, \text{Al}_2\text{O}_3 14.35, \text{SO}_3 13.54, \text{H}_2\text{O} (35.06), \) Total (108.97) wt.%. Empirical formula: \( \text{Na}_{0.85}\text{Fe}^{2+}_{6.55}\text{Al}_{3.04}\text{(SO}_4)_{1.83}(\text{OH})_{19.41}\cdot 11.30\text{H}_2\text{O} \).

**Relationship to other species:** It is the Fe\(^{2+}\)-dominant analogue of shigaite, \( \text{NaMn}^{2+}_{6}\text{Al}_3\text{(SO}_4)_2\text{(OH)}_{18}\cdot 12\text{H}_2\text{O} \), and motukoreaite, \( \text{NaMg}_6\text{Al}_3\text{(SO}_4)_2\text{(OH)}_{18}\cdot 12\text{H}_2\text{O} \).

**Name:** After Anthony (Tony) J. Nikischer (b. 1949), amateur mineralogist and mineral dealer of Peekskill, New York.

**Comments:** IMA No. 2001–039. Tony Nikischer kindly provided some of the data not given in the paper.

**References:**
- Huminicki, D.M.C. & Hawthorne, F.C. (2003): The crystal structure of nikischerite, \( \text{NaFe}^{2+}_{6}\text{Al}_3\text{(SO}_4)_2\text{(OH)}_{18}(\text{H}_2\text{O})_{12} \), a mineral of the shigaite group. *Canadian Mineralogist* 41, 79-82.
**Paratsepinite-Ba**

\[(\text{Ba},\text{Na},\text{K})_{2-x}(\text{Ti},\text{Nb})_2(\text{Si}_4\text{O}_{12})(\text{OH,OO})_2\cdot4\text{H}_2\text{O}\]

**Locality:** Lepkhe–Nelm Mountain, Lovozero massif, Kola Peninsula, Russia.

**Occurrence:** A hydrothermal mineral in an alkaline pegmatite. Associated minerals are: microcline, aegirine, nepheline, magnesio-arfvedsonite, eudialyte, lorenzenite, lamprophyllite, catapleiite, titanite, vinogradovite, tundrite-(Ce), apatite, neptunite, tsepinite-Na, kuzmenkoite-Zn, korobitsynite.

**General appearance:** Long, prismatic crystals (up to 5 mm) in cavities and as aggregates.

**Physical, chemical and crystallographic properties:**

- **Luster:** vitreous.
- **Diaphaneity:** transparent.
- **Color:** brown.
- **Streak:** white.
- **Luminescence:** nonfluorescent.
- **Hardness:** 5.
- **Tenacity:** brittle.
- **Cleavage:** not observed.
- **Fracture:** uneven.
- **Density:** 2.88 g/cm³ (meas.), 2.95 g/cm³ (calc.).
- **Crystallography:** Monoclinic, \(C2/m\), \(a = 14.551\), \(b = 14.001\), \(c = 15.702\) Å, \(\beta = 117.58°\), \(V = 2835\) Å³, \(Z = 8\), \(a:b:c = 1.0393:1.1215\). Morphology: no forms were observed. Twinning: none observed. **X-ray powder-diffraction data:** 7.11(10)(020), 4.08(8)(310), 3.95(10)(202,20\(\bar{4}\)), 3.24(9)(400,40\(\bar{4}\)), 3.11(8)(042,024), 2.403(8) (60\(\bar{2}\)), 1.914(9)(20\(\bar{8}\)), 1.634(8)(7\(5\bar{5}\)).
- **Optical data:** Biaxial (+), \(\alpha = 1.667\), \(\beta = 1.674\), \(\gamma = 1.770\). 2\(V\) (meas.) 30°, 2\(V\) (calc.) 32°; dispersion not observed; pleochroism not observed; \(X \approx c\), \(Y = b\), \(Z \perp a = 28°\) in obtuse angle \(\beta\).
- **Chemical analytical data:** Mean of five sets of electron-microprobe data (H\(_2\)O by TGA): Na\(_2\)O 1.80, K\(_2\)O 1.69, CaO 0.51, MnO 1.25, SrO 1.96, BaO 11.02, Al\(_2\)O\(_3\) 0.22, SiO\(_2\) 38.86, TiO\(_2\) 17.73, Nb_2O_5 11.60, H\(_2\)O 12.85, Total 99.50 wt.%. Empirical formula: \((\text{Ba}_{0.46}\text{Na}_{0.37}\text{K}_{0.23}\text{Sr}_{0.12}\text{Mn}_{0.11}\text{Ca}_{0.06})_{\Sigma\text{1.35}}(\text{Ti}_{1.41}\text{Nb}_{0.55})_{\Sigma\text{1.96}}(\text{Si}_{4.10}\text{Al}_{0.03})_{\Sigma\text{4.13}}\text{O}_{12.39}\{\text{OH}_1\text{O}_2\}_{\Sigma\text{2.08}}\text{•3.62H}_2\text{O}\).

**Relationship to other species:** It is a member of the labuntsovite group with Ba-dominant; the \(c\) parameter is twice that of tsepinite-Na.

**Name:** Recalls the relationship to tsepinite-Na.

**Comments:** IMA No. 2002–006.


Mineralogical Almanac
New publications of the 2003

Geology of Gems by Eugenii Kievelienko.
Edited by Dr. Art Soregaroli. First English Edition.
468 pages. 156 color plates, 128 b&w drawings, hard cover. Price: US$98
The book contains detailed and comprehensive information about gem localities over the world, and their geological setting. The book is full of geological illustrations, which make the text easily understandable. In addition we included 156 color photographs of all the main gems, mentioned in the book, taken by the best mineral photographers of the world. The book is of great value both for collectors and professionals.

This volume devoted to basic ideas of mineral ontogeny, which is a branch of Mineralogy dealing with mineral forms, their origination and transformation. This book is for those mineral collectors and amateurs who seek a deeper knowledge of minerals and want to learn about mineral structure, origin, and history from a mineral's crystal form. More than one hundred color photos of minerals together with numerous sketches give the reader a lot of new information about mineral formation. The text, color photographs and drawings are done by a prominent Russian mineral collector and writer Boris Z. Kantor.

Natural Mineral Forms by V.I. Stepanov and A.A. Godovikov.
Editor-in-Chief Margarita I. Novgorodova. Publisher Fersman Mineralogical Museum Russian Academy of Science. 64 pages, soft cover, full color, 141 color plates. Price: US$35
The book involves systematization and description of various mineral forms known in the nature. This is the first published well-illustrated course that tracks the evolution of the crystal perfectness over the wide range of mineralization conditions. It proceeds from almost ideal crystals to highly defective ones, which can be rightly identified as both individual forms and aggregates. Regularly and irregularly formed aggregates of minerals are also considered.

New Data on Minerals, volume 58.
This is the title of a science annual magazine, which 58 volume have recently appeared after eleven years of interruption. This volume contains articles on mineralogy (including descriptions of new mineral species and new finds of minerals), Mineralogical Museums and Collections. The volume is of interest for mineralogists, geochemists, geologists, museum curators, and collectors.

Mineralogical Almanac, vol. 7. Kukisvumchorr Deposit (Khibiny, Kola Peninsula)
The Khibiny Massif is the world largest alkaline pluton. It is definitely included into the top ten brightest mineralogical objects. The huge apatite deposits of the Khibiny massif have been developed for more than seventy years. The industrial development of the Khibiny started with the discovery of the Kukisvumchorr Deposit. The Apatitovyi Mine (renamed Kirovski Mine in 1935), the first mine in the USSR to the north of the Arctic Circle, started its operation in 1929. The underground mine and surrounding quarries uncovered many pegmatite and hydrothermalite bodies with a very diverse mineralization. These formations accompany the highly alkaline rocks and apatite ores of the Kukisvumchorr. For the last two decades, the most interesting mineralogical specimens were extracted from the deep levels of the deposit.

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Geochronology: Linking the Isotopic Record with Petrology and Textures

Edited by D. Vance, W. Müller and I. M. Villa

Isotope geochemistry has produced many technical developments in the past decade or so that have revolutionized the potential information available on the tectonics of metamorphic belts from geochronology. These include the ability to date minerals and rocks on small spatial scales, scales that at last approach those from which other types of information – structural and petrological – are obtained.

However, interpreting the new data, and their integration with the other datasets available, is not straightforward and requires careful chemical and textural observations that go hand-in-hand with the geochronology.

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Edited by R. D. Larter and P. T. Leat

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