NEW MINERALS

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Alsakharovite-Zn

NaSrKZn(Ti,Nb)₄[Si₄O₁₂]₂(O,OH)₄•7H₂O

MONOCLINIC

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

Occurrence: A hydrothermal mineral in cavities of a eudialyte–aegirine–feldspar pegmatite. Associated minerals are: lamprophyllite, natrolite, halloysite, ranciéite, kuzmenkoite-Zn, tsepinite-Na, vinogradovite, etc.

General appearance: Coarse, flattened prismatic crystals (up to 8 × 20 × 0.5 mm).

Physical, chemical and crystallographic properties:

Luster: vitreous. Diaphaneity: translucent to transparent. Streak: white. Luminescence: nonfluorescent. Hardness: ~5. Tenacity: brittle. Cleavage: not observed. Fracture: uneven. Density: 2.90 g/cm³ (meas.), 2.94 g/cm³ (calc.). Crystallography: Monoclinic, Cm, a 14.495, b 13.945, c 7.838 Å, β 117.75°, V 1402 Å³, Z = 2, a:b:c = 1.0394:1:0.5621. Morphology: probably {100} and {001}; elongate along [010]. Twinning: microtwinning on (001) and ( ¯401). X-ray powder-diffraction data: 6.96(100) (020,001), 3.21(80)(402,421,400), 3.11(90)(041,022,240), 2.60(35)(151,241,202), 2.50(40)(441,403), 1.74(30)(080,004), 1.70(40)(463,443,461,442). Optical data: Biaxial (+), α 1.680, β 1.687, γ 1.787, 2V(meas.) 25°, 2V(calc.) 31°; dispersion not observed; nonpleochroic; Y = b. Chemical analytical data: Mean of eight sets of electron-microprobe data (with H₂O by TGA): Na₂O 2.04, K₂O 2.43, MgO 0.04, CaO 1.48, MnO 0.11, FeO 0.22, ZnO 5.02, SrO 4.49, BaO 3.65, Al₂O₃ 0.15, SiO₂ 39.23, TiO₂ 18.89, Nb₂O₅ 12.57, H₂O 11.10, Total 101.42 wt.%. Empirical formula: (Na₀.₆₈Ca₀.₃₂)₁₀.₀₀ (Si₄O₁₂)₂(O,OH)₄•7H₂O.

Relationship to other species: It is a member of the gutkovaite subgroup of the labuntsovite group.

Name: After Alëksey S. Sakharov (1910–1996), Russian geologist who actively studied the Lovozero alkaline massif.


**Cavoite**

\[ \text{CaV}_3\text{O}_7 \]

**Orthorhombic**

**Locality:** Gambatesa mine, near Reppia, northern Appenines, Val Graveglia, Liguria, Italy.

**Occurrence:** In micro-cavities in massive bands of caryopilite + calcian rhodochrosite ± quartz. Another associated mineral is an unidentified silicate.

**General appearance:** Very rare radiating aggregates of strongly elongate prismatic to acicular crystals up to about 0.28 mm long.

**Physical, chemical and crystallographic properties:**
- **Luster:** vitreous to adamantine.
- **Diaphaneity:** transparent.
- **Color:** colorless to olive green-brown.
- **Streak:** near white.
- **Luminescence:** nonfluorescent.
- **Hardness:** could not be determined.
- **Tenacity:** brittle.
- **Cleavage:** not observed.
- **Fracture:** not mentioned.
- **Density:** could not be determined, 3.51 g/cm\(^3\) (calc.).

**Crystallography:** Orthorhombic, \(Pnam\), \(a\) 10.42, \(b\) 5.28, \(c\) 10.34 Å, \(V\) 568.2 Å\(^3\), \(Z\) = 4, \(a:b:c = 1.9735:1.9583\). Morphology: no forms were mentioned. Twinning: none observed. **X-ray powder-diffraction data:** 5.16(M)(200), 3.45(W)(211,112), 3.00(S)(212), 2.88(W)(013,203), 1.85(M)(024), 1.56(W)(612,033,216). **Optical data:** could not be determined, but a value of about 2 was measured roughly for the index of refraction.

**Chemical analytical data:** Means of ten sets of electron-microprobe data: K\(_2\)O 0.35, CaO 17.76, MnO 0.70, SiO\(_2\) 4.31, VO\(_2\) 76.80, Total 99.92 wt.%.

**Empirical formula:** \((\text{Ca}_{0.95}\text{Mn}_{0.03}\text{K}_{0.02})\Sigma_{1.00} (\text{V}_{2.79}\text{Si}_{0.22})\Sigma_{3.01}\text{O}_{7.00}\). **Relationship to other species:** It is the natural analogue of synthetic CaV\(_3\)O\(_7\).

**Name:** Recalls the chemical composition, calcium, vanadium, oxygen.

**Comments:** IMA No. 2001–024.

Ferrokentbrooksite

\[
\text{Na}_{15}\text{Ca}_{6}(\text{Fe},\text{Mn})_{3}\text{Zr}_{3}\text{NbSi}_{26}\text{O}_{73}(\text{OH},\text{H}_{2}\text{O})_{3}(\text{Cl,F,OH})_{2}
\]

Locality: Poudrette quarry, Mont Saint-Hilaire, Rouville County, Quebec, Canada. The mineral also has been found at the following localities: Narssârssuk pegmatite, Igaliko alkaline complex, southwestern Greenland; Langesundfjord area, Norway (at Brønnøya; Barkevik Strand; and the Bjørndalen quarry, Tvedalen); Kariåsen, Sandefjord area, Norway; the Burpala alkaline complex, Baikal area, Russia.

Occurrence: It is a primary but late-stage phase found in a small pegmatite dike in nepheline syenite. Associated minerals are: microcline, nepheline (partially altered to natrolite), fluorite, natrolite, gonnardite, rhodochrosite, aegirine, albite, calcite, sérandite, ancylite-(Ce) and catapleiite.

General appearance: Pseudo-octahedral crystals up to 1 cm in diameter, but much larger crystals and masses have been found in other dikes.

Physical, chemical and crystallographic properties:

- Luster: vitreous.
- Diaphaneity: transparent.
- Color: reddish brown to red.
- Streak: white.
- Hardness: 5 to 6.
- Tenacity: brittle.
- Fracture: uneven to conchoidal.
- Cleavage: none.
- Density: 3.06 g/cm\(^3\) (meas.), 3.06 g/cm\(^3\) (calc.).
- Physical data: Uniaxial (−).
- Empirical formula (based on 77.47 anions determined in the crystal structure with H\(_2\)O calculated by stoichiometry): (Na\(_{13.05}\)REEO\(_{0.99}\)K\(_{0.32}\)Ca\(_{0.23}\)Sr\(_{0.15}\))\(_{14.74}\) (Ca\(_{4.58}\)Mn\(_{1.24}\)V\(_{0.17}\))\(_{26.00}\) (Fe\(_{2.39}\)Mn\(_{0.61}\))\(_{23.00}\) (Zr\(_{1.25}\)O\(_{0.07}\))\(_{25.00}\)O\(_{73.00}\) (O,OH,H\(_2\)O)\(_{52.47}\)Cl\(_{0.89}\)F\(_{0.71}\)(OH)\(_{0.40}\)F\(_{2.00}\) - Relationship to other species: It is a member of the eudialyte group, specifically the Fe\(^{2+}\)-dominant analogue of kentbrooksite, Na\(_{15}\)Ca\(_{4}\)Mn\(_{2}\)Zr\(_{3}\)NbSi\(_{25}\)O\(_{74}\)F\(_{2}\).

Name: Recalls the relationship to kentbrooksite.

Comments: IMA No. 1999–046. The crystal structure has been solved.


JOHNSON, O., GRICE, J.D. (1999): The crystal chemistry of the eudialyte group. Canadian Mineralogist 37, 865-891 (crystal #2).
Goldquarryite

\[ \text{CuCd}_2\text{Al}_3(\text{PO}_4)_4\text{F}_2(\text{H}_2\text{O})_{10}(\text{H}_2\text{O})_2 \]

**Locality**: Gold Quarry mine, 11 km northwest of Carlin, Eureka County, Nevada, USA.

**Occurrence**: In brecciated and hydrothermally rounded jasperoid fragments lightly cemented by late-stage silicification. Associated minerals are: opal, carbonate-fluorapatite and hewettite.

**General appearance**: Isolated clusters of radiating crystals and compact parallel aggregates of crystals. Maximum size of the crystals is 1.5 mm long by 0.1 mm in diameter.

**Physical, chemical and crystallographic properties**:
- **Luster**: vitreous.
- **Diaphaneity**: transparent, but aggregates are translucent.
- **Color**: very pale blue to blue-gray, masses are blue.
- **Streak**: white.
- **Luminescence**: nonfluorescent.
- **Hardness**: 3 to 4.
- **Tenacity**: brittle.
- **Cleavage**: none observed.
- **Fracture**: irregular.
- **Density**: 2.78 g/cm³ (meas.), 2.88 g/cm³ (calc.).
- **Crystallography**: Triclinic, \( P\bar{1} \), \( a = 6.787 \), \( b = 9.082 \), \( c = 10.113 \) Å, \( \alpha = 101.40 \), \( \beta = 104.27 \), \( \gamma = 102.51 \)°, \( V = 568.7 \) Å³, \( Z = 1 \), \( a:b:c = 0.7473:1:1.1135 \). Morphology: \( \{010\} \) and \( \{001\} \) dominant, \( \{100\} \) very minor. Twinning: multiple on \( \{001\} \).
- **Optical data**: Biaxial (+), \( \alpha = 1.570 \), \( \beta = 1.573 \), \( \gamma = 1.578 \), \( 2V(\text{meas.}) = 30° \), \( 2V(\text{calc.}) = 76° \); dispersion \( r < v \), strong; pleochroic, deep blue parallel to the elongation and very pale blue normal to the elongation; orientation not given.
- **Chemical analytical data**: Mean of five sets of electron-microprobe data (with \( \text{H}_2\text{O} \) calculated to give 26 \( \text{H} + \text{F} \)): \( \text{K}_2\text{O} = 0.17 \), \( \text{CaO} = 1.25 \), \( \text{NiO} = 0.23 \), \( \text{CuO} = 5.33 \), \( \text{ZnO} = 0.05 \), \( \text{CdO} = 26.24 \), \( \text{Al}_2\text{O}_3 = 15.22 \), \( \text{V}_2\text{O}_5 = 0.05 \), \( \text{P}_2\text{O}_5 = 28.04 \), \( \text{H}_2\text{O} = 22.19 \). F 3.63, sum (102.40), less O = F 1.53, Total (100.87) wt.%. Empirical formula: \( ([\text{Cu}_{0.66}\text{Ni}_{0.03}\text{Zn}_{0.01}]\text{Cd}_{0.70}\text{Al}_{2.92}\text{V}_{0.01})\text{PO}_4_{1.87}\text{F}_{1.89}(\text{H}_2\text{O})_{12.06} \). 
- **Relationship to other species**: None apparent.

**Name**: After the locality.

**Comments**: IMA No. 2001-058.

**Kochite**

Na$_2$(Na,Ca)$_4$Ca$_4$(Mn,Ca)$_2$Zr$_2$(Si$_2$O$_7$)$_4$(O,F)$_4$F$_4$

**Triclinic**

**Locality:** The northern side of Hvide Ryg in the mountain range of Werner Bjerge on the eastern coast of Greenland (Lat. 72° N, Long. 24° W).

**Occurrence:** In a loose block of nepheline syenite between the Sirius Glacier and Hvide Ryg. Associated minerals are: nepheline, alkali feldspar and låvenite.

**General appearance:** Lath-shaped to acicular grains in parallel to subparallel aggregates up to 0.3 × 1.0 mm.

**Physical, chemical and crystallographic properties:**

- **Luster:** vitreous.
- **Diaphaneity:** transparent.
- **Color:** pale brown.
- **Streak:** not given.
- **Luminescence:** not given.
- **Hardness:** 5.
- **Tenacity:** brittle.
- **Cleavage:** {100} perfect.
- **Fracture:** uneven.
- **Density:** 3.32 g/cm$^3$ (meas.), 3.35 g/cm$^3$ (calc.).
- **Crystallography:** Triclinic, P$ar{1}$, a 10.032, b 11.333, c 7.202 Å, α 90.192, β 100.334, γ 111.551°, V 747.1 Å$^3$, Z = 1, a:b:c = 0.8852:1.0:0.6355. Morphology: no forms were observed; crystals are elongate along [010]. Twinning: none mentioned.
- **Optical data:** Biaxial (+), α 1.684, β 1.695, γ 1.718, 2V(meas.) 73°, 2V(calc.) 70°; dispersion not given; pleochroism weak with X colorless and Z pale yellow; X = c, Z // [100] ~20°.
- **Chemical analytical data:** Mean of four sets of electron-microprobe data: Na$_2$O 10.33, MgO 0.01, CaO 21.39, MnO 4.92, FeO 1.08, SrO 0.12, Al$_2$O$_3$ 0.05, V$_2$O$_5$ 0.03, Y$_2$O$_3$ 0.39, La$_2$O$_3$ 0.25, Ce$_2$O$_3$ 0.57, SiO$_2$ 31.55, TiO$_2$ 8.44, ZrO$_2$ 12.12, HF$_2$O$_2$ 0.09, Nb$_2$O$_5$ 1.86, Ta$_2$O$_5$ 0.02, F 6.83, sum 100.05, less O = F 2.88, Total 97.17 wt.%. Empirical formula: (Na$_1$Na$_{1.92}$Sr$_{0.02}$)$_{1.94}$ (Na$_{2.77}$Ca$_{1.23}$)$_{3.44}$ (Ca$_{3.52}$Na$_{0.48}$)$_{2.44}$ (Mn$_{0.07}$Ca$_{0.81}$Y$_{0.07}$Ce$_{0.05}$La$_{0.02}$)$_{2.20}$ (Zr$_{1.44}$Fe$_{0.23}$Ca$_{0.35}$Hf$_{0.01}$)$_{2.00}$ (Ti$_{1.64}$Nb$_{0.22}$Zr$_{0.11}$Al$_{0.02}$V$_{0.01}$)$_{2.20}$ (Si$_2$O$_7$)$_{4.07}$F$_4$O$_{0.47}$F$_{0.37}$O$_{1.94}$F$_{1.57}$F$_{2.35}$.

**Relationship to other species:** It is a member of the rosenbuschite group.

**Name:** After Lauge Koch (1892–1964), Danish geologist who made significant contributions to the knowledge of the geology of Greenland and mapped the geology of the type locality of this mineral.

**Comments:** IMA No. 2002-012.


**Mallestigite**

\[ \text{Pb}_3\text{Sb(SO}_4\text{(AsO}_4\text{(OH)}_6\text{)}\cdot3\text{H}_2\text{O} } \]

**Locality:** The dump of a copper–lead–zinc mine, 1 km northwest of the Mallestiger Mittagskogel, Westkarawanken, Carinthia, Austria (Lat. 46° 31' 45" N, Long. 13° 52' 24" E, altitude 1200 m above sea level).

**Occurrence:** In narrow fractures of limestones, where it formed during weathering of primary galena and tetrahedrite. Associated minerals are: anglesite, brochantite, langite, linarite and schultenite.

**General appearance:** Idiomorphic to hypidiomorphic crystals up to 2 mm long and 0.4 mm thick. Also in radial aggregate up to 3 mm in diameter.

**Physical, chemical and crystallographic properties:**
- **Luster:** adamantine.
- **Diaphaneity:** transparent to translucent.
- **Color:** colorless.
- **Streak:** white.
- **Luminescence:** nonfluorescent.
- **Hardness:** VHN\(_{10}\) 176 kg/mm\(^2\), Mohs 4.
- **Tenacity:** brittle.
- **Cleavage:** none.
- **Fracture:** splintery.
- **Density:** could not be measured, 4.91 g/cm\(^3\) (calc.).
- **Crystallography:** Hexagonal, \(P6_3\), \(a = 8.938\) Å, \(c = 11.098\) Å, \(V = 767.8\) Å\(^3\), \(Z = 2\), \(c:a = 1.2417\). Morphology: \{100\} and \{101\}; elongate on \{001\}. Twinning: none observed. X-ray powder-diffraction data:
  - \(7.74(25)(100)\), \(6.35(44)(101)\), \(3.655(100)(201)\), \(3.481(80)(112)\), \(3.175(31)(202)\), \(2.675(62)(203)\), \(2.235(35)(220)\), \(1.741(24)(224)\).
- **Optical data:** Uniaxial (+), \(\alpha = 1.760\), \(\varepsilon = 1.801\), nonpleochroic.

**Chemical analytical data:** Mean of fourteen sets of electron-microprobe data (given as elements and converted here to oxides with H\(_2\)O calculated to give 12H): PbO 65.67, Sb\(_2\)O\(_5\) 14.68, As\(_2\)O\(_5\) 9.71, SO\(_3\) 8.64, H\(_2\)O (10.38), Total (109.08) wt. %. Empirical formula: \(\text{Pb}_{3.06}\text{Sb}_{0.95}\text{[(SO}_4\text{)]}_{1.12}\text{(AsO}_4\text{)]}_{0.88}\text{[OH]}_{5.99}\text{•3H}_2\text{O}\).

**Name:** After the locality.

**Comments:** IMA No. 1996–043. 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.


**WALTER, F. (2003):** personal communication.
Niigataite

\[ \text{CaSrAl}_3(\text{Si}_2\text{O}_7)(\text{SiO}_4)\text{O(OH)} \]

**Locality:** Miyabana seashore, Ohmi Town, Itoigawa–Ohmi district, Niigata Prefecture, Japan.

**Occurrence:** In a prehnite boulder. Associated minerals are: prehnite, diaspare and chlorite. Minor constituents are: zircon, galena, cinnabar and strontian clinozoisite.

**General appearance:** Subhedral grains 0.5 mm across.

**Physical, chemical and crystallographic properties:**
- **Luster:** vitreous.
- **Diaphaneity:** transparent.
- **Color:** pale gray with a yellowish green tint.
- **Streak:** white.
- **Luminescence:** nonfluorescent.
- **Hardness:** VHN\(_{100}\) 642 to 907 kg/mm\(^2\), 5 to 5½.
- **Tenacity:** brittle.
- **Cleavage:** perfect in one direction.
- **Fracture:** not given.
- **Density:** could not be measured, 3.64 g/cm\(^3\) (calc.).

**Crystallography:** Monoclinic, \(P2_1/m\), \(a\) 8.890, \(b\) 5.5878, \(c\) 10.211 Å, \(\beta\) 115.12°, \(V\) 459.3 Å\(^3\), \(Z\) = 2, \(a:b:c\) = 1.5910:1.18274. Morphology: no forms were observed. Twinning: none mentioned. 

**X-ray powder-diffraction data:** 5.05(23)(102), 3.22(25)(201), 2.90(100)(113), 2.79(48)(020), 2.70(26)(013), 2.60(24)(311), 2.40(21)(313), 2.11(24)(221), .872(21)(22), 1.397(22)(040).

**Optical data:** Complete data could not be determined owing to the scarcity of material; indices of refraction are between 1.67 and 1.725. A violet anomalous interference-color was observed.

**Chemical analytical data:** Mean of nine sets of electron-microprobe data (with \(H_2O\) calculated to give 1 OH): \(\text{MgO}\) 0.07, \(\text{CaO}\) 14.09, \(\text{MnO}\) 0.22, \(\text{SrO}\) 14.75, \(\text{Al}_2\text{O}_3\) 24.86, \(\text{Fe}_2\text{O}_3\) 7.08, \(\text{SiO}_2\) 35.49, TiO\(_2\) 0.75, H\(_2\)O (1.77), Total (99.08) wt.%. Empirical formula: \(\text{Ca}_{1.00}(\text{Sr}_{0.72}\text{Ca}_{0.28})\text{Al}_{3}\text{Fe}_{0.45}\text{Ti}_{0.05}\text{Mn}_{0.02}\text{Mg}_{0.01})\text{Si}_3\text{O}_9\text{O}_2\text{O}(\text{OH})_1\).06. 

**Relationship to other species:** It is a member of the epidote group, specifically, the strontium-dominant analogue of clinozoisite.

**Name:** After the locality.

**Comments:** IMA No. 2001–055.

Sewardite

\[
\text{CaFe}^{3+}{}_{2}\text{(AsO}_4\text{)}_2\text{(OH)}_2
\]

**Locality:** The 31st level of the Tsumeb mine, Tsumeb, Namibia (Lat. 19° S, Long. 18° E). Also from Mina Ojuela, Mapimi, Durango, Mexico.

**Occurrence:** Associated minerals are: ferrilotharmeyerite and another species that may be a cuprian zincian ferrilotharmeyerite or the Zn-dominant analogue of lukrahnite.

**General appearance:** Platy to compact anhedral to subhedral masses (up to 0.3 mm). Individual fragments are 50 to 100 \(\mu\)m.

**Physical, chemical and crystallographic properties:**
- **Luster:** given as vitreous but the optical properties indicate adamantine.
- **Diaphaneity:** translucent to transparent.
- **Color:** dark red to much lighter red to orange.
- **Streak:** reddish brown.
- **Luminescence:** nonfluorescent.
- **Hardness:** 3\(\frac{1}{2}\).
- **Tenacity:** brittle.
- **Cleavage:** \{100\} and \{011\} both imperfect.
- **Fracture:** splintery to uneven.
- **Density:** could not be measured, 4.17 g/cm\(^3\) (calc.).
- **Crystalllography:** Orthorhombic, \(\text{Ccmm}, a \ 16.436, b \ 7.425, c \ 12.116 \ \text{Å, } V = 1479 \ \text{Å}^3, Z = 8, a:b:c = 2.2136:1:1.6318\). Morphology: no forms were observed. Twinning: none observed. X-ray powder-diffraction data: 4.874(90)(202), 3.473(50)(113), 3.389(60)(220), 3.167(100)(022), 3.015(50)(510), 2.988(50)(313), 2.919(70)(511), 2.503(90)(422,314), 1.775(50)(533,026).
- **Optical data:** In reflected light: light bluish gray with weak, but measurable birefringence, no anisotropism, nonpleochroic. \(R_1, R_2: (10.04, 10.60\%) \ 470 \text{ nm}, (9.49, 10.06\%) \ 546 \text{ nm}, (9.27, 9.95\%) \ 589 \text{ nm}, (8.80, 9.49\%) \ 650 \text{ nm}. Indices of refraction calculated from reflectances in air at 589 nm are \(n_1 \ 1.87, \ n_2 \ 1.92\).
- **Chemical analytical data:** Mean of eight sets of electron-microprobe data (with H\(_2\)O calculated by stoichiometry): CaO 11.77, CuO 0.28, ZnO 1.68, Fe\(_2\)O\(_3\) 31.65, As\(_2\)O\(_5\) 48.81, H\(_2\)O (4.04), Total (98.23) wt.%. Empirical formula: \(\text{Ca}_{0.99}(\text{Fe}_{1.87}\text{Zn}_{0.10}\text{Cu}_{0.02})_2(\text{AsO}_4)_2(\text{OH})_2(\text{H}_2\text{O})_0\text{.16}\). \(\text{21.96}\). **Relationship to other species:** It is the calcium-dominant analogue of carminite, PbFe\(^{3+}\)\(_2\)(AsO\(_4\))\(_2\)(OH)\(_2\).

**Name:** After Terry Maxwell Seward (b. 1940), Professor of Geochemistry at the Eidgenössische Technische Hochschule (ETH), Zürich, Switzerland. He collected the mineral and recognized it as a potentially new species.

**Comments:** IMA No. 2001–054.

Tedhadleyite

Hg$^{2+}$Hg$^{1+}$O$_{4}$(Cl,Br)$_{2}$

**Locality**: A small prospect pit near the long-abandoned Clear Creek mercury mine, New Idria district, San Benito County, California, USA (Lat. 36° 22'59"N, Long. 120° 43'58"W).

**Occurrence**: In a quartz-lined vug of a centimeter-size quartz vein. Associated minerals found in adjacent vugs are: native mercury, calomel, cinnabar, eglestonite and montroydite. Less than 10 µg of the mineral was available for study.

**General appearance**: A somewhat elongate spheroidal mass, 0.3 mm in longest dimension and as several small anhedral masses within the same vug, which is 2 × 1.5 mm.

**Physical, chemical and crystallographic properties**: **Luster**: adamantine to submetallic. **Diaphaneity**: opaque but translucent on thin edges. **Color**: very dark red to black. **Teneacy**: brittle. **Cleavage**: {010} poor. **Fracture**: uneven. **Density**: could not be measured, 9.27 g/cm$^3$ (calc.). **Crystallography**: Triclinic, $\overline{A}1$, $a$ 7.014, $b$ 11.855, $c$ 12.601 Å, $\alpha$ 115.56°, $\beta$ 82.57°, $\gamma$ 100.57°, $V$ 927.7 Å$^3$, $Z$ = 2, $a:b:c = 0.5916:1:1.0629$. Morphology: no forms were observed. Twinning: none observed. **X-ray powder-diffraction data**: 5.281(50)(020,111), 3.143(90)(131,222), 3.005(70)(122), 2.981(50)(211), 2.885(100)(113), 2.675(90)(233), 2.508(40)(213). **Optical data**: In reflected light: bluish white, moderate anisotropism, no bireflectance, nonpleochroic. $R_{1,2}$: 1.01. $R_{4,5}$: (27.20, 30.00; 13.20, 15.40%) 470 nm, (24.40, 27.60; 10.95, 13.30%) 546 nm, (22.80, 25.40; 9.83, 11.70%) 589 nm, (21.60, 23.90; 9.24, 10.70%) 650 nm. **Chemical analytical data**: Mean of seven sets of electron-microprobe data: Hg$_{0.98}$Hg$_{1.02}$O$_{3.71}$I$_{2.21}$(Cl$_{1.57}$Br$_{0.51}$)$_{2.06}$. **Relationship to other species**: None apparent.

**Name**: After Ted A. Hadley (b. 1961), of Sunnyvale, California, who helped collect the samples in which the mineral was discovered. He is a past-president of the Bay Area Mineralogists and a long-time mineral collector.

**Comments**: IMA No. 2001–035. Note that the structure has been determined.

**References**: ROBERTS, A.C., COOPER, M.A., HAWTHORNE, F.C., CRIDDLE, A.J., STIRLING, J.A.R. & DUNNING, G.E. (2002): Tedhadleyite, Hg$^{2+}$Hg$^{1+}$O$_{4}$(Cl,Br)$_{2}$, a new mineral species from the Clear Creek Claim, San Benito County, California. Canadian Mineralogist 40, 909-914.
Vajdakite

\[(\text{MoO}_2)_2(\text{H}_2\text{O})_2\text{As}^{3+2}\text{O}_5\cdot\text{H}_2\text{O}\]

**Locality**: The Geschieber vein on the 12th level of the Svornost mine, Jáchymov (St. Joachimsthal), approximately 20 km north of Karlovy Vary, northwestern Bohemia, Czech Republic.

**Occurrence**: On fractures near a vein approximately 5 cm thick. Associated minerals are: pyrite, marcasite, nickelskutterudite, löllingite, arsenic, arsenolite, scorodite, parascorodite, kaňkite, annabergite and köttigite.

**General appearance**: Acicular to lath-shaped crystals from 0.1 to 0.5 mm.

**Physical, chemical and crystallographic properties**:
- **Luster**: given as vitreous but the optical data indicate adamantine.
- **Diaphaneity**: translucent.
- **Color**: gray-green to grass-green; some aggregates are yellow-green.
- **Streak**: white to light gray-green.
- **Luminescence**: nonfluorescent.
- **Hardness**: could not be measured.
- **Tenacity**: brittle.
- **Cleavage**: {100} perfect, {010} good.
- **Fracture**: even.
- **Density**: 3.50 g/cm³ (meas.), 3.44 g/cm³ (calc.).
- **Crystallography**: Monoclinic, \(P_2_1/c\), \(a = 7.0515, b = 12.0908, c = 12.2190 \, \text{Å}, \beta = 101.268°, V = 1021.7 \, \text{Å}^3, Z = 4, a:b:c = 0.5832:1:1.0106\). Morphology: {100} and {010}, habit acicular to lath-like, elongate [001] and flattened on {100}. Twinning: none observed.
- **Optical data**: Biaxial (+), \(\alpha = 1.757, \beta = 1.778, \gamma = 2.04, 2V(\text{calc.}) = 35°\); dispersion not given; pleochroism \(X \approx Y\) light gray to light greenish gray, \(Z\) yellowish gray; \(X = b, Y = a, a = 1°\) in acute angle \(\beta, Z \cap c = 12°\) in obtuse angle \(\beta\).
- **Chemical analytical data**: Mean of three sets of electron-microprobe data: As\(_2\)O\(_3\) 36.59, MoO\(_3\) 53.09, H\(_2\)O 11.34, Total 101.02 wt.%. Empirical formula: \([(\text{MoO}_2)_{1.93}(\text{H}_2\text{O})_{2.00}(\text{As}_2\text{O}_5)_{0.97}]\cdot1.30\text{H}_2\text{O}\).

**Relationship to other species**: It is a diarsenite. Other diarsenites are paulmooreite, gebhardtite, fetiasite, leiteite and manganarsite.

**Name**: After Josef Vadjak (b. 1930), of Pequa Rare Minerals, Massapequa, New York, USA, who drew attention to the species, and in recognition of his significant contributions to mineralogical research on the Jáchymov ore district.

**Comments**: IMA No. 1998–031. Some of the data given here are taken from the original IMA proposal. Note that the crystal structure has been solved.

**Ondruš, P., Škála, R., Císařová, I., Vešelovský, F., Frýda, J. & Čejka, J. (2002): Description and crystal structure of vajdakite, \([(\text{Mo}^{6+}\text{O}_2)_{2}(\text{H}_2\text{O})_2\text{As}^{3+2}\text{O}_5]\cdot\text{H}_2\text{O} – a new mineral from Jáchymov, Czech Republic. American Mineralogist 87, 983-990.**
**Walkerite**

\[ \text{Ca}_{16}(\text{Mg},\text{Li},\square)_{2}[\text{B}_{13}\text{O}_{17}(\text{OH})_{12}]_{4}\text{Cl}_{6}\cdot28\text{H}_{2}\text{O} \]

**Locality:** The Potash Corporation of Saskatchewan (New Brunswick Division) mine, 5 km east of Penobsquis, Sussex area, Cardwell Parish, Kings County, New Brunswick, Canada.

**Occurrence:** In halite drill-core. Associated minerals are: halite, hydroboracite, hilgardite, volkovskite, boracite, szaibelyite, a mica-group mineral and anhydrite.

**General appearance:** Bladed crystals elongated on [001] up to 2 × 0.05 mm and bundles of fibers up to 7 mm long.

**Physical, chemical and crystallographic properties:**
- **Luster:** vitreous.
- **Diaphaneity:** transparent to translucent.
- **Color:** colorless to white.
- **Streak:** white.
- **Luminescence:** nonfluorescent.
- **Hardness:** approximately 3.
- **Tenacity:** brittle.
- **Cleavage:** none apparent.
- **Fracture:** splintery.
- **Density:** 2.07 g/cm³ (meas.), 2.05 g/cm³ (calc.).
- **Crystallography:** Orthorhombic, \(P\overline{ba}2_1\), \(a = 15.52, b = 22.74, c = 8.761\) Å, \(V = 309.1\) Å³, \(Z = 1\), \(a:b:c = 0.6825:1:0.3853\). Morphology: \{100\}, \{010\} and \{001\}. Twinning: none observed.
- **Optical data:** Biaxial (+), \(\alpha = 1.516, \beta = 1.532, \gamma = 1.554\), \(2V(\text{meas.}) = 82°\), \(2V(\text{calc.}) = 82°\); no dispersion; nonpleochroic; orientation, \(X = a, Y = b, Z = c\).
- **Chemical analytical data:** Mean of eighteen sets of electron-microprobe data: Li₂O 0.12, Na₂O 0.13, K₂O 0.07, MgO 0.58, CaO 23.05, FeO 0.32, B₂O₃ 47.17, H₂O 25.48, Cl 4.91, sum 101.83, less O = Cl 1.11, Total 100.72 wt.%. Empirical formula: \(\text{(Ca}_{15.60}\text{Na}_{0.16}\text{K}_{0.06})\text{Li}_{1.82}\text{Mg}_{0.55}\text{Fe}_{0.17}\text{Cl}_{21.02}\text{B}_{51.43}\text{O}_{68.00}\text{(OH)}_{0.48}\text{Cl}_{26}\text{(OH)}_{0.74}\text{H}_{2}\text{O}_{56.00}\text{H}_{2}\text{O}_{28.00}\text{H}_{2}\text{O}\).

**Relationship to other species:** None apparent.

**Name:** After Thomas Leonard Walker (1867–1942), former Assistant Superintendent of the Geological Survey of India, Professor of Mineralogy and Petrography at the University of Toronto, and first Director of the Royal Ontario Museum of Mineralogy. He established the journal *Contributions to Canadian Mineralogy*, predecessor of *The Canadian Mineralogist*. Among the minerals he studied were borates from the same formation as that in which walkerite occurs.

**Comments:** IMA No. 2001–051. The crystal structure has been determined.

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by László Horváth

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