

NEW MINERALS

JOSEPH A. MANDARINO[§]

94 Moore Avenue, Toronto, Ontario M4T 1V3, Canada

Ronneburgite



MONOCLINIC

Locality: The mine dump of the Lichtenberg open-pit at the southwest margin of Ronneburg, Thuringia, Germany.

Occurrence: In a uranium deposit in slates and limestones. Associated minerals are: hummerite, gypsum, epsomite, picromerite, hematite and an unidentified K–Mg–Mn vanadate. Sincosite, simplotite and straczekite were found a few meters away. More than 230 species are known from the Ronneburg deposit.

General appearance: Crystals of equant, flattened or short prismatic habit (up to 0.5 mm).

Physical, chemical and crystallographic properties: *Luster:* adamantine. *Diaphaneity:* translucent. *Color:* reddish brown. *Streak:* brownish orange. *Luminescence:* nonfluorescent. *Hardness:* 3. *Tenacity:* brittle. *Cleavage:* indistinct in one direction. *Fracture:* irregular. *Density:* 2.84 g/cm³ (meas.), 2.83 g/cm³ (calc.). **Crystallography:** Monoclinic, $P2_1/n$, a 8.183, b 9.247, c 8.651 Å, β 109.74°, V 611.4 Å³, $Z = 2$, $a:b:c = 0.8849:1:0.9355$. *Morphology:* no forms were mentioned. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 5.509 (32) ($\bar{1}11$), 3.701 (55) ($\bar{2}11$), 3.336 (100) (121), 3.118 (50) ($\bar{1}22$), 3.000 (36) (112), 2.878 (64) ($\bar{1}03$), 2.752 (68) ($\bar{2}22$). **Optical data:** Biaxial (–), α 1.925, β 1.960, γ 1.988, $2V$ (meas.) 82°, $2V$ (calc.) 82°; dispersion not given; pleochroism: X brownish orange with a distinct reddish tint, Y brownish orange, Z brownish orange; orientation could not be determined. **Chemical analytical data:** Mean of twenty sets of electron-microprobe data: K₂O 16.93, MgO 0.62, MnO 12.44, V₂O₅ 68.54, Total 98.53 wt.%. Empirical formula: K_{1.91}(Mn_{0.93}Mg_{0.08})_{Σ1.01}V_{4.01}O_{12.00}. **Relationship to other species:** It is chemically related to fianelite, Mn₂V(V,As)O₇•2H₂O.

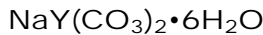
Name: After the type locality.

Comments: IMA No. 1998–069.

WITZKE, T., ZHEN, S., SEFF, K., DOERING, T., NASDALA, L. & KOLITSCH, U. (2001): Ronneburgite, K₂MnV₄O₁₂, a new mineral from Ronneburg, Thuringia, Germany: description and crystal structure. *American Mineralogist* **86**, 1081-1086.

[§] E-mail address: j.a.mandarino@puffin.net

Adamsite-(Y)



TRICLINIC

Locality: Poudrette quarry, Mont Saint-Hilaire, Rouville County, Quebec, Canada.

Occurrence: A late-stage, low-temperature hydrothermal phase in cavities in a large alkaline pegmatite dike. Associated minerals are: aegirine, albite, analcime, ancylite-(Ce), calcite, catapleiite, dawsonite, donnayite-(Y), elpidite, epididymite, eudialyte, eudidymite, fluorite, franconite, gaidonnayite, galena, genthelvite, gmelinite, gonnardite, horváthite-(Y), kupletskite, leifite, microcline, molybdenite, narsarsukite, natrolite, nenadkevichite, petersenite-(Ce), polyolithionite, pyrochlore, quartz, rhodochrosite, rutile, sabinaité, sérandite, siderite, sphalerite, thomasclarkite-(Y), zircon and an unidentified Na-REE carbonate (UK91).

General appearance: Flat, acicular to fibrous crystals (up to 2.5 cm long). Typically as spherical groups of radiating crystals and rarely as reticulated groups.

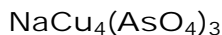
Physical, chemical and crystallographic properties: *Luster:* vitreous to pearly. *Diaphaneity:* transparent to translucent. *Color:* colorless to white, also pale pink and rarely pale purple. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 3. *Tenacity:* brittle. *Cleavage:* {001} perfect, {100} and {010} good. *Fracture:* not mentioned. *Density:* 2.27 g/cm³ (meas.), 2.27 g/cm³ (calc.). **Crystallography:** Triclinic, $P\bar{1}$, a 6.262, b 13.047, c 13.220 Å, α 91.17, β 103.70, γ 89.99°, V 1049.1 Å³, $Z = 4$, $a:b:c = 0.4800:1:1.0133$. Morphology: {010} and {001}, elongate on [001] and flat on {001}. Twinning: none mentioned. **X-ray powder-diffraction data:** 12.81(100)(001), 6.45(70)(002), 4.456(60)($\bar{1}\bar{2}1, \bar{1}20, 120, \bar{1}21$), 4.291(60)(003), 2.869(30)($\bar{1}24, 1\bar{2}3, 024$), 2.571(60)(005,043), 2.050(50)(125, plus eight others). **Optical data:** Biaxial (+), α 1.480, β 1.498, γ 1.571, $2V(\text{meas.})$ 53°, $2V(\text{calc.})$ 55°; dispersion not given; nonpleochroic; $X = c$, $Y = b$, $Z \wedge a = 14^\circ$ (in obtuse angle β). **Chemical analytical data:** Mean of seven sets of electron-microprobe data: Na₂O 8.64, CaO 0.05, Y₂O₃ 22.88, Ce₂O₃ 0.37, Nd₂O₃ 1.41, Sm₂O₃ 1.02, Gd₂O₃ 1.92, Tb₂O₃ 0.56, Dy₂O₃ 3.28, Ho₂O₃ 0.90, Er₂O₃ 2.83, Tm₂O₃ 0.27, Yb₂O₃ 1.04, CO₂ 25.10, H₂O 29.90, Total 100.17 wt.%. Empirical formula: Na_{1.00}(Y_{0.72}Dy_{0.06}Er_{0.05}Gd_{0.04}Nd_{0.03}Sm_{0.02}Yb_{0.02}Ho_{0.02}Tb_{0.01}Ce_{0.01}Tm_{0.01}) $\Sigma_{0.99}$ (CO₃)_{2.04}•5.94H₂O. **Relationship to other species:** It is chemically and structurally related to thomasclarkite-(Y), NaY(HCO₃)(OH)₃•4H₂O.

Name: After Frank Dawson Adams (1859–1942), geologist and professor at McGill University, Montreal, Canada. Among his numerous contributions to the geology and petrography of Quebec and Ontario is his research on the Monteregian Hills, of which Mont Saint-Hilaire is a member.

Comments: IMA No. 1999–020. Information on the structure is provided.

GRICE, J.D., GAULT, R.A., ROBERTS, A.C. & COOPER, M.A. (2000): Adamsite-(Y), a new sodium-yttrium carbonate mineral species from Mont Saint-Hilaire, Quebec. *Canadian Mineralogist* **38**, 1457–1466.

Bradaczekite



MONOCLINIC

Locality: North Breach of the Great fissure eruption, Tolbachik volcano, Kamchatka Peninsula, Russia.

Occurrence: In a fumarole. Associated minerals are: hematite, tenorite, lammerite, urusovite, orthoclase and johillerite.

General appearance: Aggregates of elongate plates. Individual crystals are about 0.2 mm long and 0.1 to 0.2 mm across.

Physical, chemical and crystallographic properties:

Luster: adamantine. **Diaphaneity:** transparent in transmitted light. **Color:** dark blue. **Streak:** light blue to white. **Luminescence:** nonfluorescent. **Hardness:** not given. **Tenacity:** not given. **Cleavage:** none observed. **Fracture:** not given.

Density: not given, 4.77 g/cm³ (calc.).

Crystallography: Monoclinic, *C2/c*, *a* 12.051, *b* 12.434, *c* 7.2662 Å, β 117.942°, *V* 961.8 Å³, *Z* = 4, *a*:*b*:*c* = 0.9692:1:0.5844. Morphology: {010}, { $\bar{3}11$ }, {111}, { $\bar{1}12$ } well-developed; { $\bar{3}01$ }, {001}, { $\bar{3}21$ }, { $\bar{1}01$ }, {100}, {021}, {110}, { $\bar{1}31$ }, { $\bar{1}11$ } and {341} are common. Twinning: none mentioned.

X-ray powder-diffraction

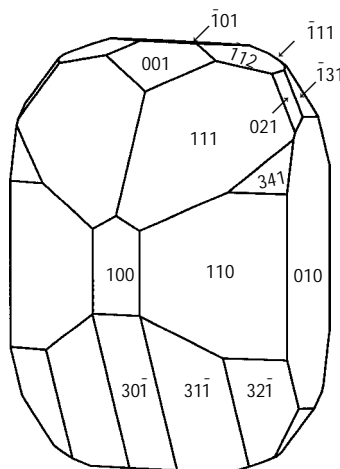
data: 6.22(13)(020), 3.60(21)($\bar{2}02$), 3.43(100)($\bar{1}12,310$), 3.21(35)(002), 2.791(24)(402), 2.696(18) (330), 2.683(30)(240), 2.665(17)(400). **Optical data:** Biaxial (-), α 1.76, β 1.92, γ 1.96, 2*V*(calc.) 50°; dispersion not given; strong pleochroism *X* violet-red, *Y* green, *Z* greenish blue; *Z* = *b*, $X \wedge c = 23^\circ$ (in obtuse angle β), $Z \wedge c = 5^\circ$ (in obtuse angle β). **Chemical analytical data:** Mean of thirty-seven sets of electron-microprobe data: Na₂O 5.17, K₂O 0.35, CuO 43.13, ZnO 0.79, Fe₂O₃ 0.38, As₂O₅ 49.62, V₂O₅ 0.13, Total 99.57 wt.% (given as 99.55). Empirical formula: (Na_{1.16}K_{0.05}) Σ _{1.21}(Cu_{3.76}Zn_{0.07}Fe³⁺_{0.03}) Σ _{3.86}(As_{1.00}O_{4.00})_{3.00}. **Relationship to other species:** It is the Na-, Cu- and AsO₄-dominant member of the alluaudite group.

Name: After Hans Bradaczek (b. 1940), structural crystallographer and former director of the Institute of Crystallography, Freie Universität, Berlin, Germany, and long-time collaborator with the crystallography group at the University of St. Petersburg, Russia.

Comments: IMA No. 2000-002.

FILATOV, S.K., VERGASOVA, L.P., GORSKAYA, M.G., KRIVOVICHEV, S.V., BURNS, P.C. & ANANIEV, V.V. (2001): Bradaczekite, NaCu₄(AsO₄)₃, a new mineral species from the Tolbachik volcano, Kamchatka Peninsula, Russia. *Canadian Mineralogist* **39**, 1115-1119.

KRIVOVICHEV, S.V., FILATOV, S.K. & BURNS, P.C. (2001): The Jahn-Teller distortion of copper coordination polyhedra in the alluaudite structure-type: the crystal structure of bradaczekite, NaCu₄(AsO₄)₃. *Zapiski Vserossiiskogo Mineralogicheskogo Obshchestva* **130**(5), 1-8 (in Russ.).



Carraraite



HEXAGONAL

Locality: Gioia quarry, Colonnata valley, Carrara basin, Apuan Alps, northern Tuscany, Italy.

Occurrence: In calcite vein cavities within the famous Carrara marble. Associated minerals are: azurite and volborthite. It is a product of hydrothermal alteration of copper-vanadium sulfides such as sulvanite and colusite. Crystals of colusite with Ge contents of 1.3 wt.% have been found in the Carrara area.

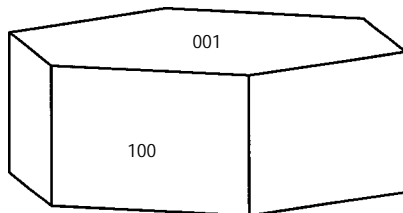
General appearance: Prismatic to tabular submillimetric crystals.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent to translucent. *Color:* white. *Streak:* white. *Luminescence:* not mentioned. *Hardness:* not given. *Tenacity:* not given. *Cleavage:* none observed. *Fracture:* not given. *Density:* could not be measured because of the small size, 1.97 g/cm³ (calc.). **Crystallography:** Hexagonal, $P6_3/m$, a 11.056, c 10.629 Å, V 1125.2 Å³, $Z = 2$, $c:a = 0.9614$. Morphology: {100}, {001}. Twinning: none mentioned. **X-ray powder-diffraction data:** 9.57(vs)(100), 5.53(s)(110), 3.83(s)(112), 3.56(ms)(202), 2.74(ms)(302), 2.53(m)(213), 2.38(m)(312), 2.18(m)(223), 2.13(m)(313). **Optical data:** Uniaxial (-), ω 1.509, ε 1.479, nonpleochroic. **Chemical analytical data:** Mean of seven sets of electron-microprobe data: CaO 35.70, GeO₂ 18.15, SO₃ 16.19, Total 70.04 wt.%. The sample decomposed in the electron beam. Here, 53.75 wt.% H₂O and 8.75 wt.% CO₂ were added to give 15(H₂O) and 1(CO₃); this raises the analytical total to 132.54 wt.%. Recalculation to give 100.00 wt.% gives: CaO 26.94, GeO₂ 13.69, SO₃ 12.22, CO₂ (6.60), H₂O (40.55), Total (100.00) wt.%. Empirical formula: Ca_{3.20}Ge_{0.87}(OH)_{5.84}(SO₄)_{1.02}(CO₃)_{1.00}•12.08H₂O. **Relationship to other species:** It is a member of the ettringite group.

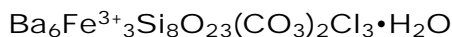
Name: After the Carrara region.

Comments: IMA No. 1998-002. Because of the very small size of the crystals, many of the usual physical properties could not be determined. Prof. Merlino kindly supplied additional data. The crystal drawing produced here is based on the SEM image in the paper.

MERLINO, S. & ORLANDI, P. (2001): Carraraite and zaccagnaite, two new minerals from the Carrara marble quarries: their chemical compositions, physical properties, and structural features. *American Mineralogist* **86**, 1293-1301.



Fencooperite



TRIGONAL

Locality: Trumbull Peak, on the western slope of the Sierra Nevada Range in NE S. 9, T3S, R19E, Mount Diablo Meridian (Lat. 37° 40' 58" N, Long. 119° 47' 08" W), about 67 km northeast of Merced and 8 km west of El Portal, Mariposa County, California, U.S.A.

Occurrence: In barium-silicate-rich lenses in quartzite. Associated minerals are: sanbornite, gillespite, quartz, titantaramellite, anandite and kinoshitalite. The fencooperite occurs in black aggregates that also contain celsian, alforsite, barite, sanbornite, quartz, pyrrhotite and diopside.

General appearance: Anhedral to roundish to platy grains (up to 100 μm).

Physical, chemical and crystallographic properties: *Luster:* vitreous to adamantine. *Diaphaneity:* opaque to translucent. *Color:* jet black to dirty gray-brown (on very thin edges). *Streak:* grayish black. *Luminescence:* nonfluorescent. *Hardness:* VHN_{10} 321 kg/mm^2 , Mohs 4½ to 5. *Tenacity:* brittle. *Cleavage:* none obvious. *Fracture:* uneven to subconchoidal. *Density:* could not be measured, 4.21 g/cm^3 (calc.). **Crystallography:** Trigonal, $P3m1$, a 10.74, c 7.095 Å, V 708.7 Å³, $Z = 1$, $c:a = 0.6606$. Morphology: no forms were observed. Twinning: none observed. **X-ray powder-diffraction data:** 3.892(100)(201), 3.148(40)(211), 2.820(90)(202), 2.685(80)(220), 2.329(30)(302,400), 2.208(40)(401), 2.136(40)(222), 2.106(30)(203). **Optical data:** Uniaxial (-), ω 1.723, ϵ 1.711, strong pleochroism O blue black, E light greenish gray. **Chemical analytical data:** Mean of twelve sets of electron-microprobe data: BaO 50.51, MnO 0.15, Al₂O₃ 1.35, Fe₂O₃ 12.77, P₂O₅ 0.16, H₂O (0.98), CO₂ (4.81), Cl 3.23, sum 101.34, less O = Cl 0.73, Total (100.61) wt.%. The valence of Fe and the amounts of H₂O and CO₂ were determined from the crystal- structure analysis. Empirical formula: Ba_{5.89}(Fe³⁺_{2.86}Mn_{0.04})_{Σ2.90}(Si_{8.14}Al_{0.47}P_{0.04})_{Σ8.65}O_{23.18}(CO₃)_{1.95}(Cl_{1.63}O_{1.37})_{Σ3.00}•0.97H₂O. **Relationship to other species:** None apparent.

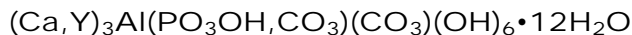
Name: After Joseph Fenimore ("Fen") Cooper, Jr. (b. 1937), of Santa Cruz, California, who helped collect the samples containing the mineral.

Comments: IMA No. 2000-023.

ROBERTS, A.C., GRICE, J.D., DUNNING, G.E. & VENANCE, K.E. (2001): Fencooperite, Ba₆Fe³⁺₃Si₈O₂₃(CO₃)₂Cl₃•H₂O, a new mineral species from Trumbull Peak, Mariposa County, California. *Canadian Mineralogist* **39**, 1059-1064.

GRICE, J.D. (2001): The crystal structure of fencooperite: unique [Fe³⁺₃O₁₃] pinwheels cross-connected by [Si₈O₂₂] islands. *Canadian Mineralogist* **39**, 1065-1071.

Micheelsenite



 HEXAGONAL

Locality: The Poudrette quarry, Mont Saint-Hilaire, Rouville County, Quebec, Canada and the Nanna pegmatite, Narsaarsuup Qaava, South Greenland.

Occurrence: Associated minerals at Mont Saint-Hilaire are: aegirine, albite, ancylite-(Ce), catapleiite, fluorite, microcline, monteregianite-(Y), natrolite, nenadkevichite, rhodochrosite and sérandite in pegmatites, and natrolite, titanite, calcite and pyrite in hornfels. Associated minerals at Nanna are aegirine, astrophyllite, analcime, calcio-ancylite-(Ce), catapleiite, fluorite, galena, gibbsite, leucophanite, microcline, natrolite, nafertisite, orthoclase, polyolithionite, sodalite (var. hackmanite) and todorokite.

General appearance: Acicular to fibrous crystals (up to 2 mm long) in loosely packed radiating groups (up to 3 mm in diameter) and as matted fibers. Also as rounded plates 0.6 mm in diameter and 0.1 mm thick.

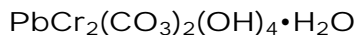
Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent to translucent. *Color:* white to colorless. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 3½ to 4. *Tenacity:* brittle. *Cleavage:* {100} and {001} good. *Fracture:* splintery. *Density:* 2.15 g/cm³ (meas.), 2.17 g/cm³ (calc.). **Crystallography:** Hexagonal, *P*6₃, *a* 10.828, *c* 10.516 Å, *V* 1067.8 Å³, *Z* = 2, *c/a* = 0.9712. Morphology: {001} and probably {100}. Twinning: none mentioned. **X-ray powder-diffraction data:** 9.38 (100) (100), 4.82 (40) (111), 4.59 (70) (102), 3.77 (50) (112), 3.36 (55) (211), 2.691 (45) (302), 2.491 (80) (213), 2.143 (65) (223). **Optical data:** Uniaxial (-), ω 1.532, ϵ 1.503, nonpleochroic. **Chemical analytical data:** Mean of three sets of electron-microprobe data: CaO 16.90, Al₂O₃ 6.70, Y₂O₃ 18.07, Gd₂O₃ 0.84, Dy₂O₃ 2.65, Ho₂O₃ 0.51, Er₂O₃ 1.88, SiO₂ 0.07, P₂O₅ 7.80, SO₃ 0.53, CO₂ (8.38), H₂O (43.01), Total (107.34) wt.%. The presence of CO₂ and H₂O was indicated by infrared and structural data, and their amounts were calculated from the stoichiometry. Empirical formula: (Ca_{1.96}Y_{1.04}Dy_{0.09}Er_{0.06}Gd_{0.03}Ho_{0.02}) Σ 3.20 Al_{0.85}[(P_{0.71}C_{0.24}S_{0.04}Si_{0.01}) Σ 1.00 O_{3.00}(OH)_{1.00}](CO₃)(OH)_{6.00}. **Relationship to other species:** A member of the ettringite group.

Name: After Harry Ingvar Micheelsen (b. 1931), Professor Emeritus of Mineralogy, University of Copenhagen, Denmark. Dr. Micheelsen discovered the Nanna pegmatite in 1963.

Comments: IMA No. 1999-033. The crystal structure has been solved.

MCDONALD, A.M., PETERSEN, O.V., GAULT, R.A., JOHNSEN, O., NIEDERMAYR, G., BRANDSTÄTTER, F. & GIESTER, G. (2001): Micheelsenite, (Ca,Y)₃Al(PO₃OH,CO₃)(CO₃)(OH)₆•12H₂O, a new mineral from Mont Saint-Hilaire, Quebec, Canada and the Nanna pegmatite, Narsaarsuup Qaava, South Greenland. *Neues Jahrbuch für Mineralogie, Monatshefte*, 337-351.

Petterdite



ORTHORHOMBIC

Locality: The Red Lead mine, Zeehan–Dundas region (Lat. 41° 53' S, Long. 145° 25' E), north-western Tasmania, Australia. It also occurs at the Callenberg Nord-1 open cut, near Glauchau, Saxony, Germany.

Occurrence: Associated minerals are: galena, goethite, anglesite, and crocoite. At the German locality, petterdite is associated with crocoite, cerussite, bindheimite, pyromorphite and galena.

General appearance: As thin (up to 0.5 mm) crusts composed of thin, roughly rectangular, platy crystals up to 15 μm across.

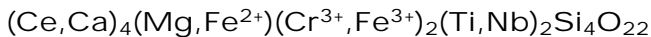
Physical, chemical and crystallographic properties: *Luster:* earthy to pearly. *Diaphaneity:* translucent. *Color:* pale grayish to pinkish violet. *Streak:* pale violet. *Luminescence:* nonfluorescent. *Hardness:* could not be measured but is assumed to be about 2. *Tenacity:* could not be observed. *Cleavage:* {100} fair, possibly also {010}. *Fracture:* could not be observed. *Density:* could not be measured because of the high porosity of the aggregates, 3.95 g/cm³ (calc.). **Crystallography:** Orthorhombic, space group not determined but assumed to be *Pbnm* by analogy with dundasite, *a* 9.079, *b* 16.321, *c* 5.786 Å, *V* 857 Å³, *Z* = 4, *a:b:c* = 0.5563:1:0.3545. Morphology: {010}, flattened on {010} and slightly elongate on [001] or less commonly on [100]. Twinning: none observed. **X-ray powder-diffraction data:** 7.937(100)(110), 4.686(50b)(021,111), 3.633(70)(131), 3.270(40)(221), 2.718(40)(022,060,112,151), 2.690(40)(241,301); the broad spacing at 4.686 is resolved into two lines at 4.73 and 4.67 with an automated diffractometer. **Optical data:** Biaxial (–), α 1.740, β ≈ 1.802, γ 1.842, 2*V* could not be measured, 2*V*(calc.) approximately 62°; dispersion not given; pleochroism *X* = *Y* colorless to pale grayish pink, *Z* grayish pink; orientation, *X* = *a*, *Y* = *b*, *Z* = *c*. **Chemical analytical data:** Mean of four sets of electron-microprobe data (H₂O calculated by difference): PbO 43.13, SrO 1.40, Al₂O₃ 3.65, Cr₂O₃ 22.64, Sb₂O₅ 0.67, CO₂ 18.3, H₂O (10.01), Total (100.00) wt.%. Empirical formula: (Pb_{0.99}Sr_{0.07})Σ1.06 (Cr_{1.52}Al_{0.36}Sb_{0.02})Σ1.90(CO₃)_{2.12}(OH)_{3.62}•1.02H₂O. **Relationship to other species:** It is the chromium-dominant analogue of dundasite, PbAl₂(CO₃)₂(OH)₄•H₂O.

Name: After William Frederick Petterd (1849–1910), an amateur collector who published several significant catalogues on the mineralogy of Tasmania. The name was once used for phosphatian mimetite.

Comments: IMA No. 1999–034.

BIRCH, W.D., KOLITSCH, U., WITZKE, T., NASDALA, L. & BOTTRILL, R.S. (2000): Petterdite, the Cr-dominant analogue of dundasite, a new mineral species from Dundas, Tasmania, Australia and Callenberg, Saxony, Germany. *Canadian Mineralogist* **38**, 1467–1476.

Polyakovite-(Ce)



MONOCLINIC

Locality: Mine N97, Ilmen Natural Reserve, southern Urals, Russia (Lat. 55°01' N, Long. 11° E).

Occurrence: In a carbonatite vein. Associated minerals are: dolomite, fluororichterite, chromite, thorianite, forsterite and phlogopite.

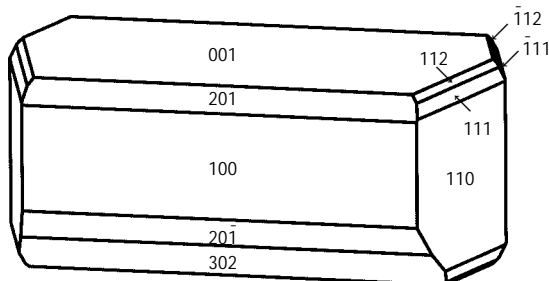
General appearance: Anhedronal equant grains usually 0.5 to 0.7 cm, but up to 2.5 cm, and as euhedral crystals up to 2 mm.

Physical, chemical and crystallographic properties: *Luster:* given as vitreous, but the optical data indicate adamantine. *Diaphaneity:* translucent in thin fragments. *Color:* black. *Streak:* brown. *Luminescence:* nonfluorescent. *Hardness:* VHN₂₀₀ 874 kg/mm², Mohs 5½ to 6. *Tenacity:* brittle. *Cleavage:* none. *Fracture:* conchoidal. *Density:* 4.75 g/cm³ (meas.), 5.05 g/cm³ (calc.). **Crystallography:** Monoclinic, *C2/m*, *a* 13.395, *b* 5.698, *c* 11.040 Å, β 100.55°, *V* 828.5 Å³, *Z* = 2, *a:b:c* = 2.3508:1:1.9375. *Morphology:* {100}, {001}, {201}, {201̄}, {110}, {111}, {111̄}, {112}, {112̄}, {302}. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 5.44(40)(002), 3.62(35)(003), 3.18(50)(311), 3.15(40)(3̄12), 3.12(35)(1̄13), 2.849(40)(020), 2.715(100)(004), 2.160(45)(421). **Optical data:** Isotropic (owing to metamictization), *n* between 1.931 and 1.935. In reflected light: gray, nonpleochroic. *R:* (11.1%) 480 nm, (10.9%) 540 nm, (10.8%) 580 nm, (10.5%) 640 nm. **Chemical analytical data:** Mean of three sets of electron-microprobe data and one set of wet-chemical data: MgO 2.61, CaO 1.06, MnO 0.05, FeO 1.09, Cr₂O₃ 7.42, Fe₂O₃ 4.30, Y₂O₃ 0.38, La₂O₃ 15.94, Ce₂O₃ 24.24, Pr₂O₃ 2.01, Nd₂O₃ 4.76, Sm₂O₃ 0.38, SiO₂ 19.08, TiO₂ 9.49, ThO₂ 2.79, UO₂ 0.03, Nb₂O₅ 3.98, H₂O 0.14, Total 99.75 wt.%. Empirical formula: (Ce_{1.87}La_{1.24}Nd_{0.36}Ca_{0.24}Pr_{0.15}Th_{0.13}Y_{0.04})_{Σ4.06}(Mg_{0.82}Fe²⁺_{0.19}Mn_{0.01})_{Σ1.02}(Cr_{1.23}Fe³⁺_{0.68})_{Σ1.91}(Ti_{1.50}Nb_{0.38})_{Σ1.88}Si_{4.01}[O_{21.80}(OH)_{0.20}]_{Σ22.00}. **Relationship to other species:** It is the Mg- and Cr³⁺-dominant analogue of chevkinite-(Ce).

Name: After Vladislav Olegovich Polyakov (1950–1993), who contributed greatly to the knowledge of the mineralogy of the Urals.

Comments: IMA No. 1998–029. Mössbauer and thermal analytical data are given, and the crystal structure has been solved.

POPOV, V.A., PAUTOV, L.A., SOKOLOVA, E., HAWTHORNE, F.C., MCCAMMON, C. & BAZHENOVA, L.F. (2001): Polyakovite-(Ce), (REE,Ca)₄(Mg,Fe²⁺)(Cr³⁺,Fe³⁺)₂(Ti,Nb)₂Si₄O₂₂, a new metamict mineral species from the Ilmen Mountains, southern Urals, Russia: mineral description and crystal chemistry. *Canadian Mineralogist* **39**, 1095–1104.



Sicherite



ORTHORHOMBIC

Locality: Lengenbach quarry, Binntal, Canton Valais, Switzerland.

Occurrence: In dolomitic rock. Associated minerals are: realgar, hutchinsonite, hatchite and jentschite.

General appearance: Aggregates (up to 2 mm across) of individual crystals (up to 0.4 mm).

Physical, chemical and crystallographic properties:

Luster: metallic. **Diaphaneity:**

opaque. **Color:** dark gray to black.

Streak: dark brown red. **Hardness:**

VHN₁₀ 58.3 kg/mm², Mohs ≤ 3. **Tenacity:**

not given, but probably brittle.

Cleavage: not observed. **Fracture:** un-

even to conchoidal. **Density:** not measured,

5.26 g/cm³ (calc.). **Crystallography:**

Orthorhombic, *Pmm*, *a* 12.479, *b*

15.522, *c* 5.719 Å, *V* 1107.8 Å³, *Z* = 4,

a:b:c = 0.8040:1:0.3684. **Morphology:**

{141} dominant, with {001}, {010},

{031}, {301} minor. **Twinning:** none

mentioned. **X-ray powder-diffraction**

data: 3.655(16)(131), 3.363(50)(301),

3.290(23)(240,311), 3.210(26)(041),

3.118(27)(141), 2.822(100)(340,

331,012), 2.540(17)(341), 2.070(15)

(600,071). **Optical data:** In reflected

light: pure white, very few dark red in-

ternal reflections, extremely weak aniso-

tropism. *R*₁, *R*₂; *imR*₁, *imR*₂: (31.43,

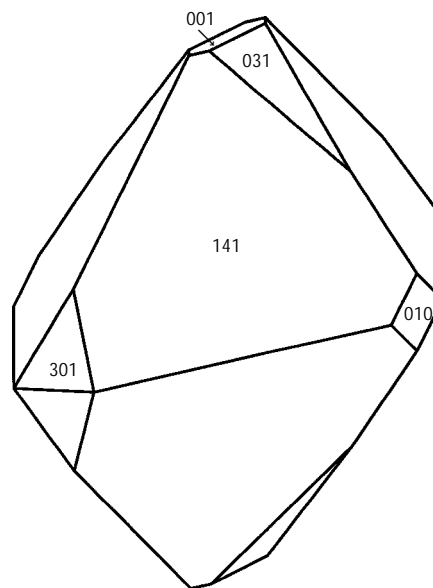
33.43; 15.98, 18.41%) 470 nm, (28.31, 30.52; 13.48, 15.80%) 546 nm, (27.10, 29.11;

12.54, 4.56%) 589 nm, (25.57, 27.44; 11.36, 13.17%) 650 nm. **Chemical analytical**

data: Mean of 103 sets of electron-microprobe data: Cu 0.22, Ag 23.98, Tl 23.63, Sb

10.96, As 19.08, S 21.65, Total 99.52 wt.%. Empirical formula: Tl_{1.02}(Ag_{1.96}Cu_{0.03})_{Σ1.99}

(As_{2.24}Sb_{0.79})_{Σ3.03}S_{5.95}.



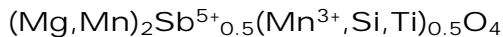
Relationship to other species: Although the chemical composition and unit cell suggest a possible relationship with the hutchinsonite group of merotypes, no simple structural relationship exists.

Name: After Valentin Sicher (b. 1925), an active member of the Lengenbach syndicates since 1963 who contributed greatly to specimen-recovery efforts.

Comments: IMA No. 1997-051.

GRAESER, S., BERLEPSCH, P., MAKOVICKY, E. & BALIĆ-ŽUNIĆ, T. (2001): Sicherite, TlAg₂(As,Sb)₃S₆, a new sulfosaltn mineral from Lengenbach (Binntal, Switzerland): description and structure determination. *American Mineralogist* **86**, 1087-1093.

Tegengrenite



TRIGONAL

Locality: Jakobsberg, Filipstad district, Värmland, Sweden (Lat. 59.83° N, Long. 14.11° E).

Occurrence: In a manganese-iron deposit in marble. Associated minerals are: hausmannite, calcite, brucite, dolomite, clinohumite, kinoshitalite, copper, barytocalcite, bindheimite and cerussite.

General appearance: Euhedral to subhedral crystals (up to 1 mm across).

Physical, chemical and crystallographic properties: *Luster:* subadamantine. *Diaphaneity:* translucent. *Color:* deep ruby red. *Streak:* not given. *Hardness:* not given. *Tenacity:* not given. *Cleavage:* none observed. *Fracture:* conchoidal. *Density:* could not be measured, 4.58 g/cm³ (calc.). **Crystallography:** Trigonal, $R\bar{3}$ or $R\bar{3}$, a 16.196, c 14.948 Å, V 3395.7 Å³, $Z = 42$, $c:a = 0.9229$. Morphology: pseudo-octahedra probably consisting of {001} and {201}. Twinning: the pseudo-octahedra consist of eight twin domains. **X-ray powder-diffraction data:** 4.98(20)(211,003), 3.052(33)(140,214), 2.608(100)(241,143,125), 2.162(28)(244), 1.6652(30)(363,075), 1.5313(26)(820), 1.5273(29)(428). **Optical data:** In reflected light: gray, practically isotropic, orange-red internal reflections seen in some cases. R: (10.4%) 470 nm, (10.0%) 546 nm, (9.9%) 589 nm, (9.8%) 650 nm. **Chemical analytical data:** Mean of 35 sets of electron-microprobe data: MgO 21.83, MnO 25.76, ZnO 2.66, Al₂O₃ 0.76, Mn₂O₃ 8.12, Fe₂O₃ 0.78, SiO₂ 1.70, TiO₂ 1.40, Sb₂O₅ 36.13, Total 99.14 wt.%. Empirical formula: (Mg_{1.22}Mn²⁺_{0.82}Zn_{0.07})_{Σ2.11}Sb⁵⁺_{0.50}(Mn³⁺_{0.23}Si_{0.06}Ti_{0.04}Al_{0.03}Fe³⁺_{0.02})_{Σ0.38}O_{4.00}. **Relationship to other species:** It is chemically related to filipstadite, Mn₂(Sb⁵⁺_{0.05}Fe³⁺_{0.05})O₄, and both are structurally related to spinel.

Name: After Felix Tegengren (1884–1980), a renowned Finnish–Swedish economic geologist who wrote tomes on the ore deposits of Sweden and China.

Comments: IMA No. 1999–002. The drawing given here is based on the probable forms {001} and {201}, which produce a pseudo-octahedron.

HOLISTAM, D. & LARSSON, A.-K. (2000): Tegengrenite, a new, rhombohedral spinel-related Sb mineral from the Jakobsberg Fe–Mn deposit, Värmland, Sweden. *American Mineralogist* **85**, 1315–1320.

