

NEW MINERALS

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Baumstarkite



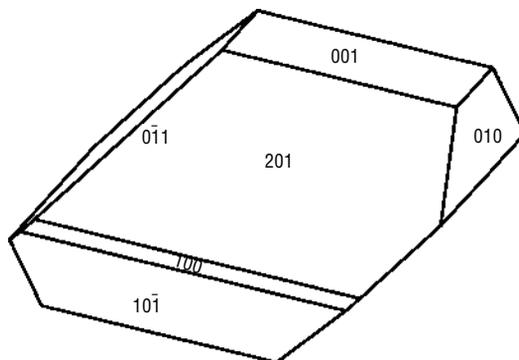
TRICLINIC

Locality: The San Genaro mine, Huancavelica Department, Castrovirreyna District, Peru.

Occurrence: Found in high-grade silver ores of hypogene origin. Associated minerals are: (dominant) miargyrite; (less frequent) pyrargyrite, stannite and k esterite; (trace) andorite, diaphorite, robinsonite, galena, chalcopyrite, sphalerite and pyrite.

General appearance: Individual crystals do not exceed 3 mm. Crystal aggregates up to 40 × 10 mm coat miargyrite. Anhedral grains in miargyrite up to several mm in diameter are common.

Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* iron-black. *Streak:* grayish black. *Hardness:* VHN₂₅ 89.3 kg/mm², Mohs 2½. *Tenacity:* sectile, somewhat pliable. *Cleavage:* {001} perfect and {100} less perfect. *Fracture:* even. *Density:* 5.33 g/cm³ (meas.), 5.39 g/cm³ (calc.). **Crystallography:** Triclinic, $P\bar{1}$, a 7.766, b 8.322, c 8.814 Å, α 100.62°, β 104.03°, γ 90.22°, V 542 Å³, $Z = 6$, $a:b:c = 0.9332:1:1.0591$. *Morphology:* {001}, {101̄}, {201}, {010} and {011̄} are most frequent, and {100} is subordinate. *Twinning:* occasionally on (001). **X-ray powder-diffraction data:** 3.425(8)(021), 3.224(6)(202̄), 2.841(8)(221,221̄), 2.798(100)(003), 2.013(5)(222), 1.971(5)(224̄), 1.3994(6)(006). **Optical data:** In reflected light: gray to white, weak to moderate bireflectance, strong to weak anisotropism, nonpleochroic. R_1 , R_2 ; $^{im}R_1$, $^{im}R_2$: (31.30, 39.65; 16.60, 23.60%) 470 nm, (29.20, 37.30; 14.60,



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21.15%) 546 nm, (27.80, 36.10; 13.35, 20.10%) 589 nm, (26.15, 33.05; 12.15, 17.60%) 650 nm. **Chemical analytical data:** Mean of twenty-two sets of electron-microprobe data: Cu 0.10, Ag 36.3, Sb 40.2, As 0.7, S 22.0, Total 99.3 wt.%. Empirical formula: $\text{Ag}_{0.99}(\text{Sb}_{0.97}\text{As}_{0.03})_{\Sigma 1.00}\text{S}_{2.01}$. **Relationship to other species:** It is the triclinic polymorph of AgSbS_2 ; the monoclinic polymorph is miargyrite, and the cubic polymorph is cuboargyrite.

Name: After Manfred Baumstark (b. 1954), German mineralogist who provided material for study.

Comments: IMA No. 1999-049. The authors gave a drawing of a twinned crystal. Here, a single crystal is shown with SHAPE; central distances were kindly provided by Dr. Herta Effenberger.

EFFENBERGER, H., PAAR, W.H., TOPA, D., CRIDDLE, A.J. & FLECK, M. (2002): The new mineral baumstarkite and a structural reinvestigation of aramayoite and miargyrite. *American Mineralogist* **87**, 753-764.

Bobkingite



MONOCLINIC

Locality: The New Cliff Hill quarry, Stanton-under-Bardon, Leicestershire, England, U.K. (grid reference SK 462 107).

Occurrence: Found in veins in diorite. Associated minerals are: copper, cuprite, malachite, azurite and a large suite of secondary copper-oxysalt minerals.

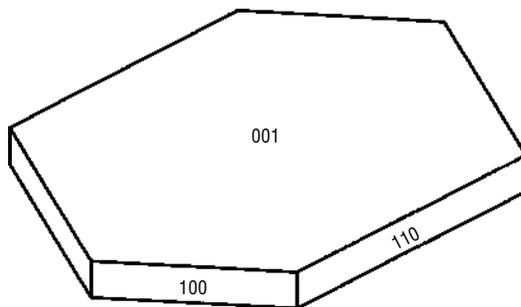
General appearance: Parallel growths of thin platy crystals (up to 0.2 mm across and $\leq 5 \mu\text{m}$ thick) on a compact fibrous crust of malachite and crystalline azurite on massive cuprite. The crystals contain numerous inclusions of malachite and (possibly) paratacamite.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* soft pale blue. *Streak:* pale blue. *Luminescence:* nonfluorescent. *Hardness:* 3. *Tenacity:* brittle. *Cleavage:* {001} perfect and {100} fair. *Fracture:* conchoidal. *Density:* could not be measured, 3.25 g/cm³ (calc.). **Crystallography:** Monoclinic, $C2/m$, a 10.301, b 6.758, c 8.835 Å, β 111.53°, V 572.1 Å³, $Z = 2$, $a:b:c = 1.5243:1:1.3073$. *Morphology:* {001} dominant with {100} and {110} minor. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 8.199(100)(001), 5.502(100)(110), 5.029(40)($\bar{2}01$), 2.883(80)(310), 2.693(40)($\bar{1}13$), 2.263(40)(113, $\bar{4}03$), 2.188(50)(23 $\bar{2}$), 1.767(40)(223). **Optical data:** Biaxial (-), α 1.724, β 1.745, γ 1.750, $2V(\text{meas.})$ 33°, $2V(\text{calc.})$ 52°; dispersion not mentioned; pleochroism distinct, X very pale blue, Z pale greenish blue; $X \wedge a = 22^\circ$ in obtuse angle β , $Y \approx c$, $Z = b$. **Chemical analytical data:** Mean of five sets of electron-microprobe data (with H₂O calculated to give 12 H): CuO 70.46, H₂O (19.19), Cl 12.71, sum 102.36, less O = Cl 2.87, Total (99.49) wt.%. Empirical formula: Cu_{4.99}Cl_{2.02}(OH)_{8.00}(H₂O)_{2.00}. **Relationship to other species:** It is chemically related to belloite, atacamite, clinoatacamite, paratacamite, botallackite, simonkollite, calumetite, anthonite, claringbullite and eriochalcite.

Name: After Robert (Bob) King (b. 1923), former mineralogist at the Department of Geology, Leicester University (U.K.), a prominent mineral collector and founding member of the Russell Society.

Comments: IMA No. 2000-029.

HAWTHORNE, F.C., COOPER, M.A., GRICE, J.D., ROBERTS, A.C. & HUBBARD, N. (2002): Description and crystal structure of bobkingite, Cu²⁺₅Cl₂(OH)₈(H₂O)₂, a new mineral from New Cliff Hill quarry, Stanton-under-Bardon, Leicestershire, UK. *Mineralogical Magazine* 66, 301-311.



Brodtkorbite



MONOCLINIC

Locality: The Tuminico selenium deposit in the northern part of the Sierra de Cacho (Sierra de Umango) mountain range, 25 to 30 km southwest of the village Bajo Jagüe, La Rioja, Argentina. The dump of Tuminico 1a is at Lat. 28° 49.9' S, Long. 68° 38.04' W, and at an altitude of 2820 m above sea level. See Comments.

Occurrence: Found in a telethermal selenide vein-type assemblage. Associated minerals are: berzelianite, bellidoite, cadmoselite (mercurian and cuprian), chaméanite, crookesite, eskebornite, eucairite, ferroselite, hakite, klockmannite, a luanheite-type phase, trogtalite–krutaite, tiemannite, tyrellite, umangite and uraninite.

General appearance: Individual anhedral grains from $10 \times 20 \mu\text{m}$, rarely to $50 \times 100 \mu\text{m}$, and as aggregates of composite grains reaching $150 \times 250 \mu\text{m}$.

Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* dark gray. *Streak:* dark gray. *Hardness:* VHN_{10} 118 kg/mm^2 , Mohs 2½ to 3. *Tenacity:* brittle. *Cleavage:* not evident. *Fracture:* uneven. *Density:* could not be measured, 7.77 g/cm^3 (calc.). *Crystallography:* Monoclinic, $P2_1/n$, a 7.492, b 4.177, c 7.239 Å, β 114.20°, V 206.6 Å³, $Z = 2$, $a:b:c = 1.7936:1:1.7331$. *Morphology:* no forms were observed. *Twinning:* none mentioned. *X-ray powder-diffraction data:* 3.991(70)(101), 3.576(50)(110), 3.534(50)(011), 3.414(50)(200), 2.730(100)($\bar{1}$ 12), 2.223(70)(211), 2.072(50)($\bar{1}$ 13, $\bar{1}$ 12). *Optical data:* In reflected light: white, weak to strong anisotropism, strong bireflectance, weak to moderate pleochroism. R_1 , R_2 ; ${}^{\text{im}}R_1$, ${}^{\text{im}}R_2$: (29.60, 37.10; 15.15, 22.00%) 470 nm, (27.40, 35.10; 13.30, 20.15%) 546 nm, (26.60, 34.60; 12.70, 19.80%) 589 nm, (26.10, 34.10; 12.30, 19.25%) 650 nm. *Chemical analytical data:* Mean of seven sets of electron-microprobe data: Cu 26.2, Hg 40.7, Se 32.9, Total 99.8 wt.%. Empirical formula: $\text{Cu}_{2.00}\text{Hg}_{0.98}\text{Se}_{2.02}$. *Relationship to other species:* It is not structurally related to imiterite, Ag_2HgSe_2 , and appears to belong to a unique prototype structure.

Name: After Milka Kronegold de Brodtkorb (b. 1932), Professor at the universities of Buenos Aires and La Plata, Argentina, for her fundamental and numerous contributions to the economic geology and mineralogy of Argentina.

Comments: IMA No. 1999–023. The latitude and longitude of the locality are interchanged in the paper.

PAAR, W.H., TOPA, D., ROBERTS, A.C., CRIDDLE, A.J., AMANN, G. & SUREDA, R.J. (2002): The new mineral species brodtkorbite, Cu_2HgSe_2 , and the associated selenide assemblage from Tuminico, Sierra de Cacho, La Rioja, Argentina. *Canadian Mineralogist* **40**, 225-237.

Buryatite



 HEXAGONAL

Locality: The Solongo deposit, Buryatiya, Russia.

Occurrence: Found in drill core in kurchatovite–sakhaite ore. Associated minerals are: calcite, fluoborite, frolovite, magnetite, kurchatovite, clinokurchatovite, fedorovskite, sakhaite, vimsite, pentahydroborite, hexahydroborite and borcarite.

General appearance: Fine-grained aggregates (up to 3×10 mm) and tabular crystals (up to 10 μm).

Physical, chemical and crystallographic properties: *Luster:* dull. *Diaphaneity:* transparent to translucent. *Color:* light gray with a lilac tint. *Streak:* white. *Luminescence:* fluoresces light blue in short-wave ultraviolet light. *Hardness:* 2½. *Tenacity:* sectile. *Cleavage:* {100} perfect. *Fracture:* rough. *Density:* could not be measured, 1.90 g/cm³ (calc.). **Crystallography:** Hexagonal, $P31c$, a 11.14, c 20.99 Å, V 2256 Å³, $Z = 4$, $c:a = 1.8842$. Morphology: {001} and {100}. Twinning: none observed. **X-ray powder-diffraction data:** 9.70(8)(100), 3.85(6)(105,114), 3.040(8db)(032,214), 2.736(6)(304), 2.596(10)(312), 2.374(6)(134), 2.121(9)(136), 1.833(6)(332), 1.498(7)(248); db: double line. **Optical data:** Uniaxial (+), ω 1.523, ε 1.532, nonpleochroic. The optic sign is given as (–), but the indices indicate (+). **Chemical analytical data:** Mean of three sets of electron-microprobe data (B_2O_3 by atomic emission spectroscopy): MgO 0.38, CaO 25.88, B_2O_3 5.70, Al_2O_3 0.75, Fe_2O_3 2.20, SiO_2 5.60, MnO_2 0.27, SO_3 12.52, H_2O 45.80, Total 99.10 wt.%. Empirical formula: $\text{Ca}_{3.01}(\text{Si}_{0.61}\text{Fe}^{3+}_{0.18}\text{Al}_{0.10}\text{Mg}_{0.06}\text{Mn}^{4+}_{0.02})_{\Sigma 0.97}(\text{SO}_4)_{1.02}[\text{B}(\text{OH})_4]_{1.07}[(\text{OH})_{5.61}\text{O}_{0.39}]_{\Sigma 6.00} \cdot 11.64\text{H}_2\text{O}$. **Relationship to other species:** It is a member of the ettringite group.

Name: After the locality.

Comments: IMA No. 2000–021.

MALINKO, S.V., CHUKANOV, N.V., DUBINCHUK, V.T., ZADOV, A.E. & KOPORULINA, E.V. (2001): Buryatite $\text{Ca}_3(\text{Si}, \text{Fe}^{3+}, \text{Al})[\text{SO}_4][\text{B}(\text{OH})_4](\text{OH})_5\text{O} \cdot 12\text{H}_2\text{O}$, a new mineral. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* **130**(2), 72–78 (in Russ.).

Bussenite



TRICLINIC

Locality: Mt. Kukisvumchorr, Khibina alkaline massif, Kola Peninsula, Russia.

Occurrence: Found in a sodalite–natrolite–calcite veinlet cross-cutting urtite. Associated minerals are: natrolite, sodalite, aegirine, biotite, vinogradovite, titanite, eudialyte, calcite, barytocalcite, fluorapatite, fluorite, djerfisherite, and molybdenite.

General appearance: Curved plates, 2 to 5 cm wide by 0.5 mm thick.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent to translucent. *Color:* yellow-brown. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 4. *Tenacity:* brittle. *Cleavage:* {001} perfect, {110} and {110} moderate. *Fracture:* stepped. *Density:* 3.63 g/cm³ (meas.), 3.73 g/cm³ (calc.). **Crystallography:** Triclinic, *P*1, *a* 5.419, *b* 7.042, *c* 16.334 Å, α 102.45°, β 93.20°, γ 90.00°, *V* 607.7 Å³, *Z* = 2, *a:b:c* = 0.7695:1:2.3195. *Morphology:* {001}. *Twinning:* none observed. **X-ray powder-diffraction data:** 3.910(44)(11̄2,111,103̄), 3.186(100)(11̄3,114,005), 3.055(38)(11̄4,113), 2.797(29)(121,123̄), 2.738(62)(123,121), 2.695(32)(200,201̄), 2.677(29)(105,015,116), 2.613(32)(122,124), 2.312(28)(016,017̄). **Optical data:** Biaxial (+), α 1.671, β 1.694, γ 1.734, 2*V*(meas.) 71°, 2*V*(calc.) 76°; dispersion *r* > *v*, strong; pleochroism *X* and *Z* pale yellow, *Y* brownish orange; *Y* ≈ *a*, *X* ∧ *c* = 5° in obtuse angle α. **Chemical analytical data:** Mean of five sets of electron-microprobe data (H₂O by Penfield method, CO₂ by weight loss minus H₂O): Na₂O 8.98, K₂O 0.65, CaO 1.56, MnO 4.68, FeO 6.77, SrO 6.78, BaO 28.79, SiO₂ 18.01, TiO₂ 11.57, Nb₂O₅ 1.04, CO₂ 5.76, H₂O 3.90, F 2.79, sum 101.28, less O = F 1.17, Total 100.11 wt.%. Empirical formula: (Na_{1.98}K_{0.09})Σ2.07(Ba_{1.28}Sr_{0.45}Ca_{0.19})Σ1.92(Fe_{0.64}Mn_{0.45})Σ1.09(Ti_{0.99}Nb_{0.05})Σ1.04Si_{2.04}O_{7.38}(CO₃)_{0.89}(OH)_{2.95}F_{1.00}. **Relationship to other species:** It has a babingtonite-like structure.

Name: After Irina V. Bussen (b. 1915), Russian petrologist, specialist in the petrology and mineralogy of the Khibina–Lovozero alkaline complex..

Comments: IMA No. 2000–035.

KHOMYAKOV, A.P., MEN'SHIKOV, YU.P., NECHELYUSTOV, G.N. & ZHOU, HUIYIN (2001): Bussenite, Na₂Ba₂Fe²⁺TiSi₂O₇(CO₃)(OH)₃F, a new mica-like titanosilicate from the Khibina alkaline massif (Kola Peninsula). *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* 130(3), 50-55 (in Russ.).

Cobaltneustädteelite



TRICLINIC

Locality: The dumps of the Guldener Falk mine near Schneeberg–Neustädte, Schneeberg area, Saxony, Germany. It also has been found on the dumps of other mines in the area: Siebenschlecken, Junge Kalbe, Friedefürst and Peter und Paul.

Occurrence: Associated minerals are: quartz, neustädteelite, preisingerite and goethite; rarely found with mixite, zeunerite and bismutite.

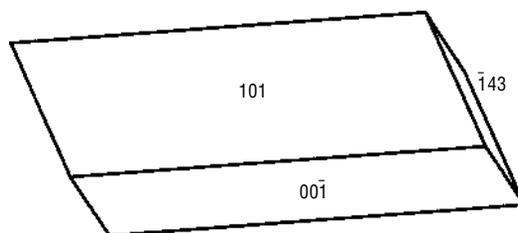
General appearance: Crystal aggregates (up to 0.3 mm) and as very small tabular crystals usually <0.1 mm thick. One specimen has crystals up to 0.2 mm in diameter and 0.1 mm thick.

Physical, chemical and crystallographic properties: *Luster:* adamantine. *Diaphaneity:* transparent to translucent. *Color:* brown. *Streak:* light brown. *Luminescence:* nonfluorescent. *Hardness:* 4½. *Tenacity:* brittle. *Cleavage:* {001} good. *Fracture:* conchoidal. *Density:* could not be measured, 5.81 g/cm³ (calc.). **Crystallography:** Triclinic, $P\bar{1}$, a 9.156, b 6.148, c 9.338 Å, α 83.24°, β 70.56°, γ 86.91°, V 492.2 Å³, $Z = 2$, $a:b:c = 1.4893:1:1.5189$. Morphology: {001}, {100}, "{011}", rarely {201}; the form given as "{011}" could not be measured accurately and may be $\bar{1}43$. *Twinning:* none observed. **X-ray powder-diffraction data:** 8.757(55)(001), 3.752(100)(211,202,012), 3.552(55)(210), 3.507(44)($2\bar{1}1,2\bar{1}0$), 2.901(96)(203), 2.750(39)(013), 2.667(72)($20\bar{2}$), 2.531(41)($01\bar{3}$). **Optical data:** Biaxial (-), α 2.02, β 2.09 (calc.), γ 2.12, $2V(\text{meas.})$ 65°, no distinct dispersion observed; pleochroism strong, X brown to opaque, Y yellow, Z pale yellow; ϕ and ρ relative to (010): X -166° and 86°, Y -74° and 76°, Z 88° and 15°. **Chemical analytical data:** Mean of fifteen sets of electron-microprobe data: CaO 0.32, NiO 1.61, CoO 5.47, CuO <0.05, ZnO 0.39, PbO 0.08, Al₂O₃ 0.07, Fe₂O₃ 10.90, Bi₂O₃ 51.54, P₂O₅ 0.43, As₂O₅ 25.91, H₂O 3.01, Total 99.73 wt.%. Empirical formula: $(\text{Bi}_{1.91}\text{Ca}_{0.05})_{\Sigma 1.96}\text{Fe}_{1.02}(\text{Co}_{0.63}\text{Ni}_{0.19}\text{Fe}_{0.16}\text{Zn}_{0.04}\text{Al}_{0.01})_{\Sigma 1.03}[(\text{OH})_{2.88}\text{O}_{1.12}]_{\Sigma 4.00}[(\text{AsO}_4)_{1.95}(\text{PO}_4)_{0.05}]_{\Sigma 2.00}$. **Relationship to other species:** It is a member of the medenbachite group, specifically the Co²⁺-dominant member.

Name: Reflects the relationship with neustädteelite.

Comments: IMA No. 2000-012.

KRAUSE, W., BERNHARDT, H.-J., MCCAMMON, C. & EFFENBERGER, H. (2002): Neustädteelite and cobaltneustädteelite, the Fe³⁺- and Co²⁺-analogues of medenbachite. *American Mineralogist* 87, 726-738.



Cronusite



TRIGONAL

Locality: Norton County meteorite (enstatite achondrite), which fell on February 18, 1948, in Nebraska, U.S.A.

Occurrence: Associated minerals are: enstatite, ferroan alabandite, troilite and daubréelite. Cronusite is a product of the terrestrial weathering of caswellsilverite, NaCrS_2 .

General appearance: Grains up to 1 mm.

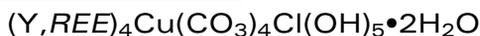
Physical, chemical and crystallographic properties: *Luster:* submetallic. *Diaphaneity:* opaque. *Color:* coal black. *Streak:* black. *Hardness:* VHN_{10} 98 kg/mm^2 , Mohs 1½. *Tenacity:* sectile. *Cleavage:* {001} perfect. *Fracture:* uneven. *Density:* 2.51 g/cm^3 (meas.), 2.54 g/cm^3 (calc.). *Crystallography:* Trigonal, $R3m$, $R\bar{3}m$ or $R32$, a 3.326, c 33.29 Å, V 318.9 Å³, Z = 3, $c:a$ = 10.0090. *Morphology:* no forms were observed. *Twinning:* none mentioned. *X-ray powder-diffraction data:* 11.1(100)(003), 5.56(10)(006), 3.700(4)(009), 2.719(5)(104), 2.464(4)(107), 2.180(4)(1.0.10). *Optical data:* In reflected light: gray, strong anisotropism, strong bireflectance, pleochroic in gray colors. R_1 , R_2 : (14.5, 15.8%) 460 nm, (15.7, 17.6%) 540 nm, (16.2, 18.2%) 580 nm, (16.6, 18.6%) 660 nm. *Chemical analytical data:* Mean of six sets of electron-microprobe data: K 0.6, Ca 4.2, Cr 33.7, S 39.1, O 21, H (calc.) 2.65, Total 101.25 wt.%. Empirical formula (based on $\text{Cr} + \text{S} = 3$): $\text{Ca}_{0.17}\text{K}_{0.03}(\text{H}_2\text{O})_{2.11}\text{Cr}_{1.04}\text{S}_{1.96}$. *Relationship to other species:* None apparent.

Name: After Cronos, one of the Titans in Greek mythology, the son of Uranus and Gaea, alluding to the mixed meteoritic-terrestrial origin of the mineral.

Comments: IMA No. 1999–018.

BRITVIN, S.N., GUO, Y.X., KOLOMENSKY, V.D., BOLDYREVA, M.M., KRETZER, YU.L. & YAGOVKINA, M.A. (2001): Cronusite, $\text{Ca}_{0.2}(\text{H}_2\text{O})_2\text{CrS}_2$, a new mineral from the Norton County enstatite achondrite. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* 130(3), 29–36 (in Russ.).

Decrespignyite-(Y)



MONOCLINIC

Locality: The Paratoo copper deposit, 30 km southwest of Yunta, Olary district, South Australia, Australia (Lat. 32° 41' S, Long. 139° 20' E).

Occurrence: A supergene mineral in narrow fissures of a fine-grained, inhomogeneous dolomitic slate. Associated minerals are: muscovite, caysichite-(Y), donnayite-(Y), kamphaugite-(Y), malachite, nontronite, "limonite" pseudomorphs after pyrite, calcite and gypsum. Other rare-earth minerals found in the deposit but not directly associated with decrespignyite-(Y) are: a Y-rich bastnäsite-(La), a Y-rich calcio-ancylite-(Nd) and a new Ca-La-Cu carbonate.

General appearance: Crusts (up to 5 mm thick), coatings and fillings in thin fissures. Less common are globular aggregates of thin pseudo-hexagonal crystals (10 to 50 μm in maximum dimension and <0.5 μm thick).

Physical, chemical and crystallographic properties: *Luster:* vitreous to pearly. *Diaphaneity:* transparent. *Color:* intense royal blue to turquoise-blue. *Streak:* pale blue. *Luminescence:* nonfluorescent. *Hardness:* aggregates 2, individual crystals estimated to be 4. *Tenacity:* not given. *Cleavage:* could not be observed, but if present, is {010}. *Fracture:* not given. *Density:* 3.64 g/cm³ (meas.), 3.82 g/cm³ (calc.). See Comments. **Crystallography:** Monoclinic, *P2*, *Pm* or *P2/m*, *a* 8.899, *b* 22.77, *c* 8.589 Å, β 120.06°, *V* 1506.3 Å³, *Z* = 4, *a:b:c* = 0.3908:1:0.3772. *Morphology:* no forms were mentioned. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 22.79(30)(010), 7.463(30)(001), 7.086(50)(011), 6.241(100)(021), 4.216(30)($\bar{1}$ 12), 3.530(40)(022), 3.336(30)(032), 2.143(30)(222, $\bar{4}$ 01). **Optical data:** Biaxial (-), α 1.604, β could not be measured but is very close to γ, γ 1.638, 2*V* could not be measured but must be very small, dispersion could not be measured; pleochroism medium strong, X very pale bluish, Y and Z bluish with a greenish tint, *Z* ≈ *Y* >> *X*; orientation not given. **Chemical analytical data:** Mean of seven sets of electron-microprobe data (H₂O and CO₂ by CHN analyzer): CaO 0.50, CuO 10.90, Y₂O₃ 42.20, La₂O₃ 0.30, Pr₂O₃ 0.10, Nd₂O₃ 1.30, Sm₂O₃ 1.00, Gd₂O₃ 4.80, Tb₂O₃ 0.40, Dy₂O₃ 3.70, Ho₂O₃ 2.60, Er₂O₃ 2.50, CO₂ 18.80, H₂O 10.80, Cl 3.00, sum 103.90, less O = Cl 0.68, Total 103.22 wt.%. Empirical formula: (Y_{3.13}Gd_{0.22}Dy_{0.17}Ho_{0.12}Er_{0.11}Ca_{0.07}Nd_{0.06}Sm_{0.05}Tb_{0.02}La_{0.02}Pr_{0.01})_{Σ3.98}Cu_{1.15}(CO₃)_{3.77}[Cl_{0.71}(OH)_{0.29}]_{Σ1.00}(OH)_{5.63}•2.07H₂O. See Comments. **Relationship to other species:** Probably structurally related to kamphaugite-(Y).

Name: After Robert James Champion de Crespigny (b. 1950), Executive Chairman of Normandy Mining Limited, Chancellor of the University of Adelaide and Chairman of the South Australian Museum, in recognition of his contribution to the Australian mining industry and Australian education.

Comments: IMA No. 2001-027. The calculated density given in the paper is 3.645 g/cm³ rather than 3.82 g/cm³ given here. The empirical formula in the paper has subscripts that are somewhat different from those given here. Dr. Pring agrees with the calculated density and empirical formula presented here.

WALLWORK, K., KOLITSCH, U., PRING, A. & NASDALA, L. (2002): Decrespignyite-(Y), a new copper yttrium rare earth carbonate chloride hydrate from Paratoo, South Australia. *Mineralogical Magazine* 66, 181-188.

Feklichevite



TRIGONAL

Locality: The Kovdor phlogopite mine, Kovdor alkaline-ultrabasic complex, Kola Peninsula, Russia.

Occurrence: Found in a pegmatitic vein of cancrinite syenite. Associated minerals are: K-feldspar, cancrinite, aegirine–diopside, pectolite, titanite, hematite and pyrrhotite.

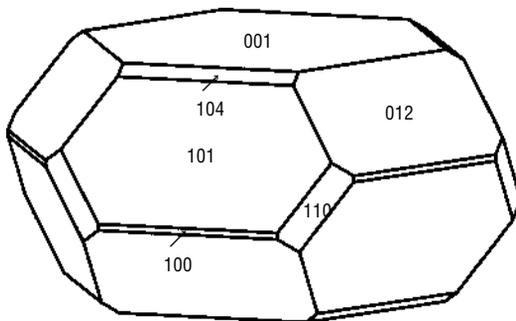
General appearance: Equant to thick tabular crystals and grains (up to 2.5 cm).

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* translucent. *Color:* dark brown. *Streak:* brownish. *Luminescence:* nonfluorescent. *Hardness:* 5½. *Tenacity:* brittle. *Cleavage:* {001} perfect. *Fracture:* stepped to rough. *Density:* 2.87 g/cm³ (meas.), 2.85 g/cm³ (calc.). **Crystallography:** Trigonal, *R3m*, *a* 14.255, *c* 30.170 Å, *V* 5309.3 Å³, *Z* = 3, *c:a* = 2.1165. *Morphology:* {001}, {110}, {100}, {101}, {104}, {012}, {021} and {267}. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 6.43(39)(104), 4.31(69)(205), 3.53(37)(027), 3.218(56)(208), 3.170(34)(036,217), 3.036(42)(119,042), 2.977(81)(135), 2.854(100)(404), 2.602(44)(039). **Optical data:** Uniaxial (+), *ω* 1.616, *ε* 1.620, nonpleochroic. **Chemical analytical data:** Mean of twelve sets of electron-microprobe data (H₂O by Penfield method): Na₂O 11.45, CaO 15.55, MnO 0.49, FeO 2.08, SrO 0.28, Fe₂O₃ 3.20, La₂O₃ 0.11, Ce₂O₃ 0.16, SiO₂ 50.35, ZrO₂ 11.65, HfO₂ 0.62, TiO₂ 0.12, Nb₂O₅ 2.41, H₂O 1.72, F 0.12, Cl 0.61, sum 100.92, less O = F + Cl 0.19, Total 100.73 wt.%. Empirical formula: Na_{11.13}(Ca_{8.35}Mn_{0.21}Sr_{0.08}Ce_{0.03}La_{0.02})Σ8.69(Fe³⁺_{1.21}Fe²⁺_{0.87})Σ2.08(Zr_{2.85}Hf_{0.09}Ti_{0.05})Σ2.99Nb_{0.55}[Si_{25.24}O_{73.00}][(OH)_{2.41}(H₂O)_{1.67}O_{0.21}Cl_{0.52}F_{0.19}]Σ5.00. **Relationship to other species:** It is a member of the eudialyte group.

Name: After Vladimir Georgevich Feklichev (1933–1999), mineralogist and crystallographer, author of *Diagnostic Constants of Minerals* (1992).

Comments: IMA No. 2000–017.

PEKOV, I.V., EKIMENKOVA, I.A., CHUKANOV, N.V., RASTSVETAeva, R.K., KONONKOVA, N.N., PEKOVA, N.A. & ZADOV, A.E. (2001): Feklichevite, Na₁₁Ca₉(Fe³⁺, Fe²⁺)₂Zr₃Nb[Si₂₅O₇₃](OH, H₂O, Cl, O)₅, a new mineral of the eudialyte group from the Kovdor massif, Kola Peninsula. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* **130**(3), 55–65 (in Russ.).



Ferronordite-(La)



ORTHORHOMBIC

Locality: Mount Bol'shoi Punkaruaiiv, Lovozero alkaline complex, Kola Peninsula, Russia.

Occurrence: Found in the ussingite core of two hyperagpaitic pegmatites. Associated minerals are: aegirine, epistolite, sphalerite, steenstrupine-(Ce) and altered sérandite.

General appearance: Tabular crystals up to $8 \times 5 \times 1$ mm and spherulites up to 1.5 cm in diameter.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* colorless to pale brown. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 5. *Tenacity:* brittle. *Cleavage:* {100} perfect. *Fracture:* uneven. *Density:* 3.54 g/cm³ (meas.), 3.58 g/cm³ (calc.). **Crystallography:** Orthorhombic, *Pcca*, *a* 14.440, *b* 5.191, *c* 19.86 Å, *V* 1489 Å³, *Z* = 4, *a:b:c* = 2.7817:1:3.8259. *Morphology:* mainly {100}. *Twinning:* none observed. **X-ray powder-diffraction data:** 7.20(40)(200), 4.21(100)(210), 3.323(82)(312), 2.964(88)(410), 2.873(99)(314), 2.595(58)(020), 2.442(44)(406). **Optical data:** Biaxial (-), α 1.624, β 1.637, γ 1.644, *2V*(meas.) 60°, *2V*(calc.) 72°; dispersion *r* > *v*, weak; nonpleochroic; orientation, *X* = *a*, *Y* = *c*, *Z* = *b*. **Chemical analytical data:** Mean of four sets of electron-microprobe data: Na₂O 11.23, MgO 0.30, CaO 0.53, MnO 2.50, FeO 3.75, ZnO 2.29, SrO 12.69, BaO 0.36, Al₂O₃ 0.14, La₂O₃ 11.36, Ce₂O₃ 8.21, Pr₂O₃ 1.00, Nd₂O₃ 0.89, SiO₂ 44.06, Total 99.31 wt.%. Empirical formula: (Na_{2.93}Ca_{0.08}) Σ 3.01(Sr_{0.99}Ba_{0.02}) Σ 1.01(La_{0.56}Ce_{0.40}Pr_{0.05}Nd_{0.04}) Σ 1.05 (Fe_{0.42}Mn_{0.28}Zn_{0.23}Mg_{0.06}) Σ 0.99(Si_{5.92}Al_{0.02}) Σ 5.94O_{17.00}. **Relationship to other species:** It is the La-dominant analogue of ferronordite-(Ce).

Name: Reflects the relationship with ferronordite-(Ce).

Comments: IMA No. 2000-015.

PEKOV, I.V., CHUKANOV, N.V., TURCHKOVA, A.G. & GRISHIN, V.G. (2001): Ferronordite-(La), Na₃Sr(La,Ce)FeSi₆O₁₇, a new mineral of the nordite group from the Lovozero massif, Kola Peninsula. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* 130(2), 53-58 (in Russ.).

Gmelinite-K



 HEXAGONAL

Locality: Mount Alluaiv, Lovozero alkaline complex, Kola Peninsula, Russia.

Occurrence: Found in cavities within brecciated pegmatite. Associated minerals are: K-feldspar, nepheline, sodalite, cancrinite, amphibole, pyroxene and other minerals.

General appearance: Granular and radial aggregates of columnar to acicular crystals (up to 0.1 × 3 mm).

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* colorless to brownish. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* VHN₃₀ 258 kg/mm², Mohs 4. *Tenacity:* brittle. *Cleavage:* not observed. *Fracture:* conchoidal. *Density:* 2.00 g/cm³ (meas.), 2.04 g/cm³ (calc.). **Crystallography:** Hexagonal, *P*6₃/*mmc*, *a* 13.696, *c* 10.203 Å, *V* 1657.5 Å³, *Z* = 1, *c:a* = 0.7450. Morphology: {100}, {101} and {001}. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 11.9(80)(010), 5.16(70)(021,002), 4.11(100)(121,112), 3.27(70)(130,013), 2.971(80)(040), 2.852(80)(041,222), 2.719(100)(123). **Optical data:** Uniaxial (–), ω 1.477, ε 1.471, nonpleochroic. **Chemical analytical data:** Mean of four sets of electron-microprobe data (recalculated to 100.00 wt.%): Na₂O 2.63, K₂O 7.54, CaO 1.56, Al₂O₃ 18.53, SiO₂ 50.54, H₂O 19.20, Total 100.00 wt.%. Empirical formula: (K_{3.25}Na_{1.73}Ca_{0.57})_{Σ5.55}[(Al_{7.39}Si_{17.10})_{Σ24.49}O_{48.34}]•21.66H₂O. **Relationship to other species:** It is a member of the zeolite group and the K-dominant member of the gmelinite series.

Name: Reflects the relationship to the other members of the gmelinite series.

Comments: IMA No. 1999–039.

KHOMYAKOV, A.P., POLEZHAeva, L.I. & MALINOVSKY, YU.A. (2001): Gmelinite-K, (K,Na,Ca)₆[Al₇Si₁₇O₄₈]•22H₂O, a new zeolite mineral from the Lovozero alkaline massif, Kola Peninsula, Russia. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* 130(3), 65-71 (in Russ.).

VEZZALINI, G., QUARTIERI, S. & PASSAGLIA, E. (1990): Crystal structure of a K-rich natural gmelinite and comparison with the other refined gmelinite samples. *Neues Jahrbuch für Mineralogie, Monatshefte*, 504-516.

Kanonerovite



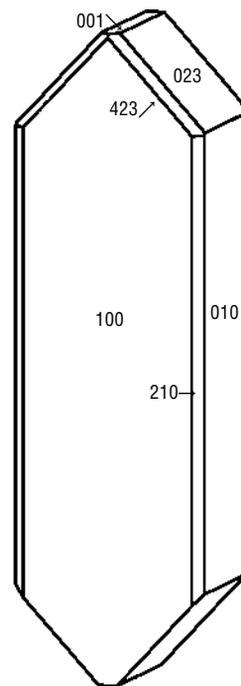
MONOCLINIC

Locality: Kazennitsa pegmatite vein, Alabashka pegmatite field, Middle Urals, Russia (Lat. 57°47' N, Long. 61°03' E).

Occurrence: Found in cavities of a muscovite-bearing granitic pegmatite that cuts biotite granite-gneisses and porphyritic granites. Associated minerals are: muscovite, quartz, elbaite, topaz, milarite, calcite, chabazite, stilbite-stellerite, rutile, fluorite, pyrrhotite, sphalerite and pyrite.

General appearance: As a crust (0.1 to 1.2 mm) on quartz, topaz and cassiterite crystals. Individual crystals have dimensions of a few tenths of millimeters.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* colorless. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 2½ to 3. *Tenacity:* brittle. *Cleavage:* {010} poor. *Fracture:* uneven. *Density:* 1.91 g/cm³ (meas.), 1.88 g/cm³ (calc.). **Crystallography:** Monoclinic, $P2_1/n$, a 14.71, b 9.33, c 15.13 Å, β 89.8°, V 2075 Å³, $Z = 4$, $a:b:c = 1.5766:1:1.6217$. *Morphology:* {100}, {001}, {010}, {023}, {423} and {210}; habit platy on {100} and elongate on [001]. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 10.50(75) (101, $\bar{1}$ 01), 7.36(100)(200), 6.95(90)(111, $\bar{1}$ 11), 3.316(60)(411, $\bar{4}$ 11, $\bar{1}$ 23, 321, $\bar{3}$ 21, 313), 3.162(50)(214, $\bar{2}$ 14), 2.889(60)(420, 124, 032), 2.391(48)($\bar{2}$ 25, 206, $\bar{2}$ 06). **Optical data:** Biaxial (-), α 1.453, β 1.459, γ could not be determined, $2V$ could not be determined, dispersion not observed; nonpleochroic; $X \wedge c = 0$ to 7°. **Chemical analytical data:** Mean of eighteen sets of electron-microprobe data (with H₂O calculated to give 12H₂O): Na₂O 14.80, K₂O 0.05, MgO 0.14, CaO 0.20, MnO 11.20, FeO 0.15, P₂O₅ 35.23, H₂O (36.46), Total (98.23) wt.%. Empirical formula: (Mn_{0.95}Mg_{0.02}Fe_{0.01}) $\Sigma_{0.98}$ (Na_{2.86}Ca_{0.02}K_{0.01}) $\Sigma_{2.89}$ P_{2.98}O_{9.87}•12.13H₂O. **Relationship to other species:** It is the natural equivalent of the synthetic triphosphate.



Name: After Aleksandr Anatol'evich Kanonerov (b. 1955), mining historian at the Nizhnii Tagil Museum of Mining Industry of the Middle Urals, and mineral collector who first collected the mineral in 1995.

Comments: IMA No. 1997-016.

POPOVA, V.I., POPOV, V.A., SOKOLOVA, E.V., FERRARIS, G. & CHUKANOV, N.V. (2002): Kanonerovite, $\text{MnNa}_3\text{P}_3\text{O}_{10} \cdot 12\text{H}_2\text{O}$, first triphosphate mineral (Kazennitsa pegmatite, Middle Urals, Russia). *Neues Jahrbuch für Mineralogie, Monatshefte*, 117-127.

Laflammeite



MONOCLINIC

Locality: The Kirakkajuppura PGE deposit in the Penikat layered complex, Finland.

Occurrence: Found in altered pyroxenite. Associated minerals are: actinolite, clinocllore, chromite, vysotskite, zvyagintsevite, cuprorhodsitite – ferrorhodsitite – malanite, lauriterlichmanite, irarsite, keithconnite, Pb–Pd-rich thiospinels of Cu, Fe, Rh and Ir, unnamed $\text{Pd}_9\text{PbO}_{10}$ and $\text{Rh}(\text{Ni,Fe,Cu})_2\text{S}_3$, palladian gold, chalcopyrite, bornite and millerite.

General appearance: Commonly as individual subhedral platelets (up to 150 μm) and as intergrowths with members of the vysotskite–braggite series. The largest subhedral crystal is 0.3 mm.

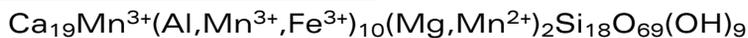
Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* megascopic color unknown. *Streak:* dark gray. *Hardness:* VHN_{50} 171 kg/mm^2 , Mohs 3½. *Tenacity:* quite brittle. *Cleavage:* inferred to be {010} perfect. *Fracture:* not given. *Density:* could not be determined, 9.41 g/cm^3 (calc.). *Crystallography:* Monoclinic, by analogy with other parkerite-type phases probably $C2/m$, a 11.521, b 8.294, c 8.321 Å, β 134.38°, V 568.3 Å³, $Z = 4$, $a:b:c = 1.3891:1:1.0033$. *Morphology:* no forms were observed. *Twinning:* finely twinned. *X-ray powder-diffraction data:* 5.953(6)(001), 4.144(10)(020), 3.379(4)(021), 2.917(9)($\bar{2}20$), 2.413(8)(022), 2.365(7)($\bar{4}22$), 2.082(5)(040). *Optical data:* In reflected light: cream with a brownish tint, weak anisotropism from brownish gray to grayish brown, weak bireflectance, nonpleochroic. R_1 , R_2 ; ${}^{\text{im}}R_1$, ${}^{\text{im}}R_2$: (45.3, 46.2; 31.55, 32.45%) 470 nm, (46.5, 47.55; 32.6, 33.75%) 546 nm, (47.7, 48.8; 33.9, 55.05%) 589 nm, (49.6, 50.0; 36.0, 36.3%) 650 nm. *Chemical analytical data:* Mean of twenty-six sets of electron-microprobe data: Pd 39.16, Ir 1.08, Pb 52.01, S 7.90, Total 100.15 wt.%. Empirical formula: $(\text{Pd}_{2.96}\text{Ir}_{0.05})_{\Sigma 3.01}\text{Pb}_{2.02}\text{S}_{1.98}$. *Relationship to other species:* Possibly isostructural with parkerite, $\text{Ni}_3(\text{Bi,Pb})_2\text{S}_2$.

Name: After J.H. Gilles Laflamme (b. 1947), Mining and Mineral Sciences Laboratories, Canada Centre for Mineral and Energy Technology, Ottawa, Canada, specialist in the micro-analysis of platinum-group minerals.

Comments: IMA No. 2000–014.

BARKOV, A.Y., MARTIN, R.F., HALKOAHO, T.A.A. & CRIDDLE, A.J. (2002): Laflammeite, $\text{Pd}_3\text{Pb}_2\text{S}_2$, a new platinum-group mineral species from the Penikat layered complex, Finland. *Canadian Mineralogist* 40, 671–678.

Manganvesuvianite



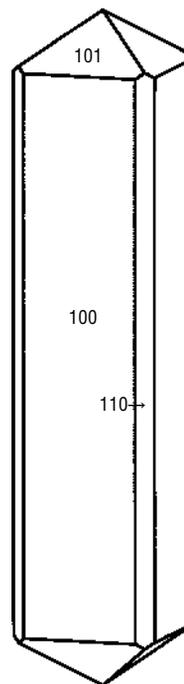
TETRAGONAL

Locality: The Wessels mine and the N'Chwaning II mine, Kalahari manganese fields, Republic of South Africa.

Occurrence: Crystals filling veins and vugs. At the N'Chwaning II mine, it is a rock-forming mineral intergrown with manganese-poor grossular or xonotlite and calcite in lenticular calc-silicate bodies within manganese ore beds. Additional associated minerals are: calcite, sérandite–pectolite, strontio Piemontite–tweddillite, mozarite and hydrogrossular–henritermierite.

General appearance: Long prismatic crystals (up to 1.5 cm).

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* small crystals transparent, large crystals opaque. *Color:* small crystals red to lilac, large crystals nearly black. *Streak:* white. *Luminescence:* not mentioned. *Hardness:* 6 to 7. *Tenacity:* brittle. *Cleavage:* not observed. *Fracture:* subconchoidal. *Density:* not measured because of strong chemical zoning, 3.40 g/cm³ (calc.). **Crystallography:** Tetragonal, $P4/n$, a 15.575, c 11.824 Å, V 2868.5 Å³, $Z = 2$, $c:a = 0.7592$. *Morphology:* {100} dominant, {110} minor, {101}. *Twinning:* none mentioned. **X-ray powder-diffraction data:** not given because of the strong chemical zoning. **Optical data:** Uniaxial (-), ω 1.731, ε 1.719, pleochroism strong, O dark red, E yellowish. See Comments. **Chemical analytical data:** Mean of nineteen sets of electron-microprobe data: Na₂O 0.02, MgO 2.35, CaO 35.73, CuO 0.02, SrO 0.11, Al₂O₃ 14.73, Mn₂O₃ 6.79, Fe₂O₃ 1.12, SiO₂ 36.15, H₂O 2.67, F 0.06, Cl 0.01, sum 99.76, less O = F + Cl 0.03, Total 99.73 wt.%. Empirical formula: (Ca_{18.87}Sr_{0.03}Na_{0.02}) Σ 18.92 Mn³⁺_{1.00}(Al_{8.38}Mn³⁺_{1.20}Fe³⁺_{0.42}) Σ 10.00(Mg_{1.73}Mn_{0.35}) Σ 2.08(Si_{17.82}Al_{0.18}) Σ 18.00O_{69.12}[(OH)_{8.78}F_{0.09}Cl_{0.01}] Σ 8.88. See Comments. **Relationship to other species:** It is a member of the vesuvianite group.



Name: Reflects the chemical relationship to vesuvianite.

Comments: IMA No. 2000–040. The symbols ω and ε are interchanged for 589 nm in the paper. No empirical formula is given in the paper, but the abstractor has produced the one given here. The crystal drawing was produced here from the information given in the paper and was approved by Prof. Armbruster.

ARMBRUSTER, T., GNOS, E., DIXON, R., GUTZMER, J., HEJNY, C., DÖBELIN, N. & MEDENBACH, O. (2002): Manganvesuvianite and tweddillite, two new Mn³⁺-silicate minerals from the Kalahari manganese fields, South Africa. *Mineralogical Magazine* 66, 137–150.

Menshikovite



 HEXAGONAL

Locality: (1) The Vostok deposit, Lukkulaisvaara layered complex, northern Karelia, Russia, and (2) the Chiney layered lopolith in the Kodar–Udokan horst, western Aldan Shield, Chita region, Siberia, Russia. A small grain has been identified also from the Oktyabr' deposit, Noril'sk complex, northern Siberia, Russia.

Occurrence: (1) In an altered gabbro-norite associated mainly with chalcopyrite, pentlandite, violarite, actinolite and clinocllore; several other PGM species also occur here. (2) In mineralized quartz–feldspar sandstones associated mainly with biotite, amphibole and chlorite; numerous other PGM species and other sulfides also occur here.

General appearance: Anhedral grains (<5 μm to 0.2 mm).

Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* megascopic color not given. *Streak:* not given. *Hardness:* $\text{VHN}_{40,50,65}$ 517.1 kg/mm^2 , Mohs 5. *Tenacity:* brittle. *Cleavage:* not observed. *Fracture:* not given. *Density:* could not be determined, 5.32 g/cm^3 (calc.) for $Z = 2$ and 10.65 g/cm^3 (calc.) for $Z = 4$. **Crystallography:** Hexagonal, $P6_3/m$, $P6_3$ or $P6_322$, a 8.406, c 6.740 \AA , V 412.4 \AA^3 , $Z = 2$ or 4, $c:a = 0.8018$. Morphology: no forms were mentioned. Twinning: fine twins are present. **X-ray powder-diffraction data:** 2.626(10)(112), 2.477(10)(202), 2.429(8)(300), 2.283(7)(301), 1.978(7)(113), 1.818(7)(400), 1.781(7)(222). **Optical data:** In reflected light: pink, locally with a slight grayish tint, weak anisotropism from light gray to brownish gray, no bireflectance, pleochroism not mentioned. R_1 , R_2 ; ${}^{\text{im}}R_1$, ${}^{\text{im}}R_2$: (48.4, 50.2; 38.5, 39.3%) 470 nm, (51.2, 53.2; 41.0, 41.8%) 546 nm, (53.2, 55.3; 42.3, 43.3%) 589 nm, (56.6; 58.7, 46.6, 47.8%) 650 nm. **Chemical analytical data:** Mean of ninety-eight sets of electron-microprobe data: Ni 17.77, Fe 0.07, As 33.91, Pd 48.18, Pt 0.07, Total 100.00 wt.%. Empirical formula: $\text{Pd}_{2.99}(\text{Ni}_{2.00}\text{Fe}_{0.01})_{\Sigma 2.01}\text{As}_{2.99}$. **Relationship to other species:** None apparent. It may form a solid-solution series with majakite, PdNiAs.

Name: After Yurii P. Men'shikov (b. 1934), Geological Institute of the Kola Science Center, Russian Academy of Sciences, Apatity, Russia.

Comments: IMA No. 1993–057.

BARKOV, A.Y., MARTIN, R.F., PAKHOMOVSKY, YA.A., TOLSTYKH, N.D. & KRIVENKO, A.P. (2002): Menshikovite, $\text{Pd}_3\text{Ni}_2\text{As}_3$, a new platinum-group species from two layered complexes, Russia. *Canadian Mineralogist* **40**, 679–692.

Nabesite



ORTHORHOMBIC

Locality: On the Kvanefjeld Plateau, in the northwesternmost part of the Ilímaussaq alkaline complex, South Greenland.

Occurrence: Found in tugtupite-bearing albitite. Associated minerals are: aegirine, analcime, beryllite, bertrandite, chkalovite, epistolite, galena, manganoan pectolite, microcline, Na-komarovite, neptunite, pyrochlore, sphalerite and tugtupite. Crystal-lined cavities contain albite, nabesite, gmelinite, neptunite, analcime, gonnardite, lovdarite, an unidentified phase presumed to be trona, and possibly opal.

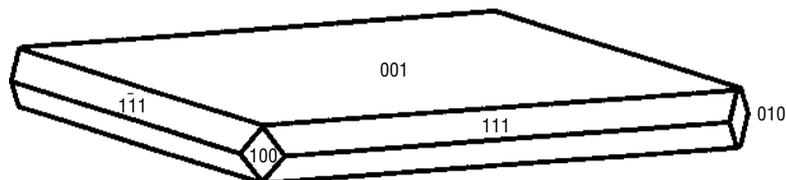
General appearance: Crystals range from $0.05 \times 0.5 \times 0.5$ to $0.2 \times 5 \times 5$ mm and occur as aggregates (up to $5 \times 10 \times 10$ mm) of thin platy crystals in parallel or subparallel orientation.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* colorless. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 5 to 6. *Tenacity:* brittle. *Cleavage:* {110} and {001} good. *Fracture:* uneven. *Density:* 2.16 g/cm³ (meas.), 2.22 g/cm³ (calc.). *Crystallography:* Orthorhombic, $P2_12_12_1$, a 9.722, b 10.142, c 12.030 Å, V 1186.2 Å³, $Z = 4$, $a:b:c = 0.9586:1:1.1862$. Morphology: {100}, {010}, {001}, {111} and $\{1\bar{1}1\}$; platy on {001}. *Twinning:* none mentioned. *X-ray powder-diffraction data:* 6.11B(80)(111), 5.97(100)(002), 5.07(35)(020), 3.46(45)(113), 3.09D(70)(310,131), 3.06(50)(222,004), 2.988D(60)(311) [B: broad, D: double]. *Optical data:* Biaxial (-), α 1.499, β 1.507, γ 1.511, $2V(\text{meas.})$ 65°, $2V(\text{calc.})$ 70°; no dispersion; no pleochroism; orientation, $X = a$, $Y = c$, $Z = b$. *Chemical analytical data:* Mean of three sets of electron-microprobe data (Na₂O by SEM-EDS, BeO and H₂O calculated from the ideal formula derived by crystal-structure analysis): Na₂O 13.8, K₂O 0.34, BeO (6.26), CaO 0.13, SiO₂ 62.4, H₂O (18.05), Total (100.98) wt.%. Empirical formula: (Na_{1.75}K_{0.03}Ca_{0.01})_{Σ1.79}Be_{0.98}Si_{4.09}O_{10.06}•3.94H₂O. *Relationship to other species:* It is a member of the zeolite group and is related to weinebeneite, CaBe₃(PO₄)₂(OH)₂•4H₂O.

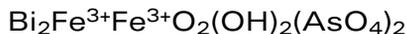
Name: Reflects the chemical composition: *Na*, *Be* and *Si*.

Comments: IMA No. 2000-024.

PETERSEN, O.V., GIESTER, G., BRANDSTÄTTER, F. & NIEDERMAYR, G. (2002): Nabesite, Na₂BeSi₄O₁₀•4H₂O, a new mineral species from the Ilímaussaq alkaline complex, South Greenland. *Canadian Mineralogist* 40, 173-181.



Neustädtelite



TRICLINIC

Locality: The dumps of the Guldener Falk mine near Schneeberg–Neustädtel, Schneeberg area, Saxony, Germany. It also has been found on the dumps of other mines in the area: Siebenschlecken, Junge Kalbe, Friedefürst and Peter und Paul.

Occurrence: Associated minerals are: quartz, cobaltneustädtelite, preisingerite and goethite; rarely with mixite, zeunerite and bismutite.

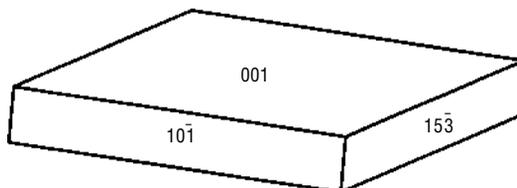
General appearance: Crystal aggregates (up to 0.3 mm) and as very small tabular crystals, usually <0.1 mm thick.

Physical, chemical and crystallographic properties: *Luster:* adamantine. *Diaphaneity:* transparent to translucent. *Color:* brown. *Streak:* light brown. *Luminescence:* nonfluorescent. *Hardness:* 4½. *Tenacity:* brittle. *Cleavage:* {001} good on some crystals. *Fracture:* conchoidal. *Density:* could not be measured, 5.81 g/cm³ (calc.). **Crystallography:** Triclinic, $P\bar{1}$, a 4.556, b 6.153, c 8.984 Å, α 95.43°, β 99.20°, γ 92.95°, V 246.9 Å³, $Z = 1$, $a:b:c = 0.7405:1:1.4601$. *Morphology:* {001}, $\{10\bar{1}\}$ and “{01 $\bar{1}$ }”; the latter form could not be measured accurately and may be {15 $\bar{3}$ }. *Twinning:* none observed. **X-ray powder-diffraction data:** 8.827(67)(001), 3.766(83)(01 $\bar{2}$,101,1 $\bar{1}$ 0), 3.542(94)(1 $\bar{1}$ 1), 3.505(87)(110,11 $\bar{1}$), 2.913(100)(102), 2.798(48)(021), 2.668(72)(10 $\bar{3}$), 2.549(43)(013), 1.767(46)(22 $\bar{2}$,005). **Optical data:** Biaxial (–), α 2.02, β 2.09 (calc.), γ 2.12, $2V(\text{meas.})$ 65°, no distinct dispersion observed; pleochroism strong, X brown to opaque, Y yellow, Z pale yellow; ϕ and ρ relative to (010) $X = -3^\circ$ and 79° , $Y = -107^\circ$ and 37° , $Z = 95^\circ$ and 55° . **Chemical analytical data:** Mean of thirteen sets of electron-microprobe data: CaO 0.15, NiO 0.34, CoO 3.35, CuO 0.07, ZnO 0.09, PbO 0.08, Al₂O₃ 0.29, Fe₂O₃ 13.92, Bi₂O₃ 52.58, P₂O₅ 0.23, As₂O₅ 26.82, H₂O 2.56, Total 100.48 wt.%. Empirical formula: (Bi_{1.94}Ca_{0.02}) Σ 1.96Fe_{1.00}(Fe_{0.50}Co_{0.38}Al_{0.05}Ni_{0.04}Zn_{0.01}Cu_{0.01}) Σ 0.99[(OH)_{2.44}O_{1.40}] Σ 3.84[(AsO₄)_{2.01}(PO₄)_{0.03}] Σ 2.04. **Relationship to other species:** It is a member of the medenbachite group, specifically the Fe³⁺-dominant member.

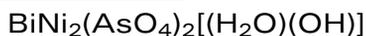
Name: After the locality.

Comments: IMA No. 1998–016.

KRAUSE, W., BERNHARDT, H.-J., MCCAMMON, C. & EFFENBERGER, H. (2002): Neustädtelite and cobaltneustädtelite, the Fe³⁺- and Co²⁺-analogues of medenbachite. *American Mineralogist* 87, 726-738.



Nickelschneebergite



MONOCLINIC

Locality: The mining area known as "Am Roten Berg", approximately 4.8 km southwest of the center of Schneeberg, Saxony, Germany.

Occurrence: Found in small vugs of coarse quartz with no other associated minerals. On other specimens of schneebergite–nickelschneebergite, the associated minerals are: Co- or Ni-bearing ferrilotharmeyerite, cobaltlotharmeyerite, nickellotharmeyerite, preisingerite, waylandite and zeunerite.

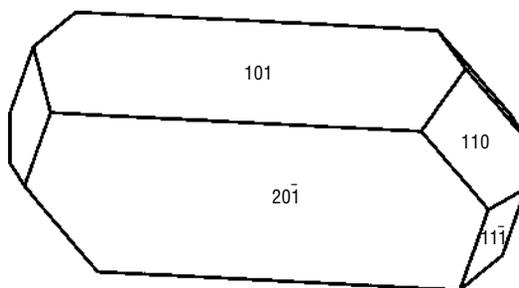
General appearance: Aggregates (up to 1 mm) and tabular elongate crystals (≤ 0.5 mm).

Physical, chemical and crystallographic properties: *Luster:* adamantine. *Diaphaneity:* transparent. *Color:* brown to beige. *Streak:* light brown to nearly white. *Luminescence:* nonfluorescent. *Hardness:* VHN_{15} 250 kg/mm^2 , Mohs 4 to $4\frac{1}{2}$. *Tenacity:* brittle. *Cleavage:* none observed. *Fracture:* conchoidal. *Density:* could not be measured, 5.23 g/cm^3 (calc.). *Crystallography:* Monoclinic, $C2/m$, a 8.995, b 6.207, c 7.462 Å, β 115.00°, V 377.6 Å³, $Z = 2$, $a:b:c = 1.4492:1:1.2022$. *Morphology:* {201}, {001}, {101}, {101}, {111}, tabular on {201} and elongate on [010]. *Twinning:* none observed. *X-ray powder-diffraction data:* 6.759(29)(001), 4.586(40)(111), 3.196(100)(112), 2.980(72)(201), 2.821(44)(021), 2.507(47)(112), 1.877(28)(113), 1.702(57)(331, 404, 511), 1.673(30)(423). *Optical data:* Biaxial (-), α 1.92 (calc.), β 1.95, γ 1.97, $2V(\text{meas.})$ 77°, dispersion not determined; pleochroism weak, Y light brown, X and Z pale yellow; $X \approx c$, $Y = b$, $Z \wedge a = 25^\circ$ in obtuse angle β . *Chemical analytical data:* Mean of seven sets of electron-microprobe data: CaO 2.68, NiO 14.75, CoO 7.98, ZnO 0.09, PbO 0.09, Fe₂O₃ 2.19, Bi₂O₃ 28.54, P₂O₅ 0.08, As₂O₅ 38.26, H₂O 4.72, Total 99.64 wt.%. Empirical formula: $(\text{Bi}_{0.73}\text{Ca}_{0.29}\text{Pb}_{0.01})_{\Sigma 1.02} (\text{Ni}_{1.18}\text{Co}_{0.64}\text{Fe}_{0.16})_{\Sigma 2.03} [(\text{AsO}_4)_{1.99}(\text{PO}_4)_{0.01}]_{\Sigma 2.00} [(\text{H}_2\text{O})_{1.10}(\text{OH})_{0.93}]_{\Sigma 2.03}$. *Relationship to other species:* It is a member of the tsumcorite group, specifically the Bi-dominant analogue of nickellotharmeyerite.

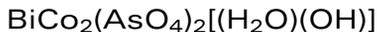
Name: Reflects its relationship with schneebergite.

Comments: IMA No. 1999–028. Dr. Krause kindly supplied the SHAPE data for the drawing produced here.

KRAUSE, W., BERNHARDT, H.-J., EFFENBERGER, H. & WITZKE, T. (2002): Schneebergite and nickelschneebergite from Schneeberg, Saxony, Germany: the first Bi-bearing members of the tsumcorite group. *European Journal of Mineralogy* 14, 115-126.



Schneebergite



MONOCLINIC

Locality: The mining area known as "Am Roten Berg", approximately 4.8 km southwest of the center of Schneeberg, Saxony, Germany.

Occurrence: Found in small vugs of coarse quartz associated with scorodite and barium-pharmacosiderite. On other specimens or schneebergite–nickelschneebergite, the associated minerals are: Co- or Ni-bearing ferrilotharmeyerite, cobaltlotharmeyerite, nickellotharmeyerite, preisingerite, waylandite and zeunerite.

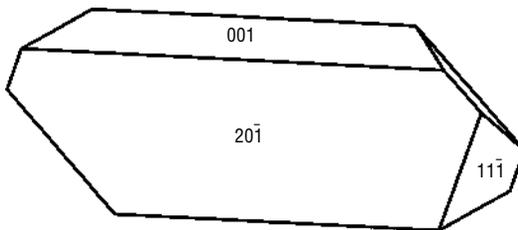
General appearance: Aggregates (up to 1 mm) and tabular elongated crystals (≤ 0.5 mm).

Physical, chemical and crystallographic properties: *Luster:* adamantine. *Diaphaneity:* transparent. *Color:* brown to beige. *Streak:* light brown to nearly white. *Luminescence:* nonfluorescent. *Hardness:* VHN_{15} 250 kg/mm^2 , Mohs 4 to 4½. *Tenacity:* brittle. *Cleavage:* none observed. *Fracture:* conchoidal. *Density:* could not be measured, 5.28 g/cm^3 (calc.). **Crystallography:** Monoclinic, $C2/m$, a 9.005, b 6.211, c 7.440 Å, β 115.19°, V 376.5 Å³, $Z = 2$, $a:b:c = 1.4498:1:1.1979$. *Morphology:* {201}, {001}, {102}, {111}, tabular on {201} and elongate on [010]. *Twinning:* none observed. **X-ray powder-diffraction data:** 4.589(61)(11 $\bar{1}$), 3.193(100)(11 $\bar{2}$), 2.971(92)(201), 2.820(61)(021), 2.702(57)(31 $\bar{1}$), 2.498(62)(112,310), 1.704(52)(33 $\bar{1}$,40 $\bar{4}$,51 $\bar{1}$), 1.674(51)(004,42 $\bar{3}$). **Optical data:** Biaxial (+), α 1.93 (calc.), β 1.95, γ 1.98, $2V(\text{meas.})$ 85°, dispersion not determined; pleochroism distinct, Y brown, X and Z pale yellow; $X \approx c$, $Y = b$, $Z \wedge a = 25^\circ$ in obtuse angle β . **Chemical analytical data:** Mean of twelve sets of electron-microprobe data: CaO 2.72, NiO 9.35, CoO 13.31, PbO 0.11, Fe₂O₃ 2.95, Bi₂O₃ 29.01, As₂O₅ 38.42, SO₃ 0.11, H₂O 4.40, Total 100.38 wt.%. Empirical formula: $(\text{Bi}_{0.74}\text{Ca}_{0.29})_{\Sigma 1.03}(\text{Co}_{1.06}\text{Ni}_{0.75}\text{Fe}_{0.22})_{\Sigma 2.03}[(\text{AsO}_4)_{1.99}(\text{SO}_4)_{0.01}]_{\Sigma 2.00}[(\text{H}_2\text{O})_{0.91}(\text{OH})_{1.09}]_{\Sigma 2.00}$. **Relationship to other species:** It is a member of the tsumcorite group, specifically the Bi-dominant analogue of cobaltlotharmeyerite.

Name: After the locality. The name was used long ago for a mineral shown to be roméite, and now has been approved by the CNMMN IMA for the present use.

Comments: IMA No. 1999–027. Dr. Krause kindly supplied the SHAPE data for the drawing produced here.

KRAUSE, W., BERNHARDT, H.-J., EFFENBERGER, H. & WITZKE, T. (2002): Schneebergite and nickelschneebergite from Schneeberg, Saxony, Germany: the first Bi-bearing members of the tsumcorite group. *European Journal of Mineralogy* 14, 115-126.



Thomsonite-Sr



ORTHORHOMBIC

Locality: Mount Rasvumchorr and Mount Yuksporr, Khibina alkaline complex, Kola Peninsula, Russia.

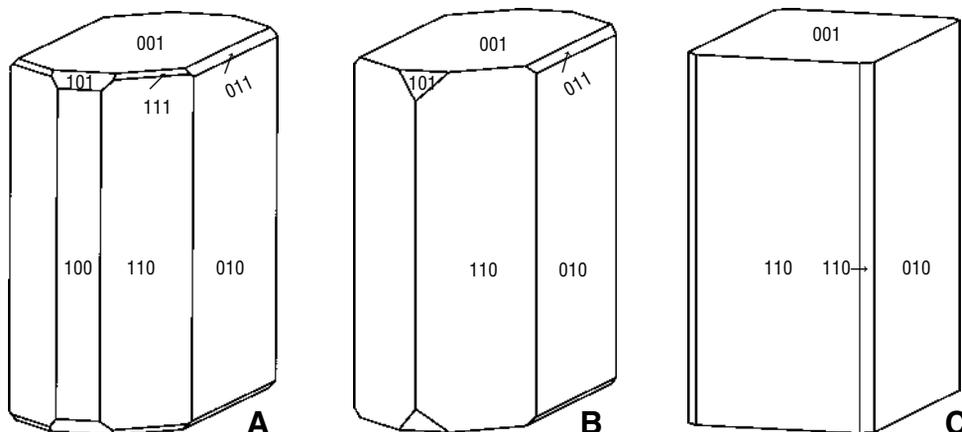
Occurrence: At Rasvumchorr, in veinlets cross-cutting natrolite of risschorrite pegmatite; associated minerals are: microcline, aegirine, annite, astrophyllite, magnetite, fluorapatite, pyrophanite, thomsonite-Ca, etc. At Yuksporr, in a veinlet cross-cutting urtite, as zones in thomsonite-Ca; associated minerals are: calcite, fluorapophyllite, tobermorite, thaumasite and barite.

General appearance: Euhedral crystals up to 0.2×0.2 mm (Rasvumchorr) and zones up to 0.02 mm (Yuksporr).

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* colorless. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 5. *Tenacity:* brittle. *Cleavage:* {100} perfect, {010} good. *Fracture:* uneven. *Density:* 2.47 g/cm³ (meas.), 2.62 g/cm³ (calc.). *Crystallography:* Orthorhombic, *Pcnn*, *a* 13.050, *b* 13.123, *c* 13.241 Å, *V* 2268 Å³, *Z* = 4, *a:b:c* = 0.9944:1:1.0090. *Morphology:* {100}, {010}, {001}, {110}, {101}, {011}. *Twinning:* none observed. *X-ray powder-diffraction data:* 6.63(7)(002), 4.66(8)(020,220), 3.49(9)(312,321), 3.19(8)(223,232,322), 2.960(10)(024,204,042), 2.860(10)(142,241,412), 2.691(10)(242), 2.186(7)(244,060,600). *Optical data:* Biaxial (+), α 1.528, β 1.532, γ 1.540, $2V$ (meas.) 62°, $2V$ (calc.) 71°; dispersion $r > v$, weak; nonpleochroic; orientation, $X = a$, $Y = c$, $Z = b$. *Chemical analytical data:* Mean of ten sets of electron-microprobe data: Na₂O 3.22, K₂O 0.14, CaO 3.85, SrO 16.27, BaO 0.24, Al₂O₃ 27.65, Fe₂O₃ 0.03, SiO₂ 33.51, H₂O 14.10, Total 99.01 wt.%. Empirical formula: (Sr_{1.42}Ca_{0.62}Ba_{0.01}) Σ 2.05(Na_{0.94}K_{0.03}) Σ 0.97 [Si_{5.03}Al_{4.89}O_{19.94}]•7.06H₂O. *Relationship to other species:* It is a member of the zeolite group, specifically the thomsonite series.

Name: Reflects the relationship to other members of the thomsonite series.

Comments: IMA No. 2000-025.



- PEKOV, I.V., LOVSKAYA, E.V., TURCHKOVA, A.G., CHUKANOV, N.V., ZADOV, A.E., RASTSVETAEVA, R.K. & KONONKOVA, N.N. (2001): Thomsonite-Sr $(\text{Sr,Ca})_2\text{Na}[\text{Al}_5\text{Si}_5\text{O}_{20}] \cdot 6-7\text{H}_2\text{O}$, a new zeolite mineral from the Khibina massif (Kola Peninsula) and the thomsonite-Ca – thomsonite-Sr isomorphous series. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* **130**(4), 46-55 (in Russ.).

Tischendorfite



ORTHORHOMBIC

Locality: The Eskaborner Stollen (Eskeborn adit), at the 60-meter level, 5 meters north of the blind shaft IV, near Tilkerode, Harz Mountains, Germany.

Occurrence: Found in telethermal selenide veins. Associated minerals are: chrisstanleyite, tiemannite, clausthalite, stibiopalladinite, gold, ankerite and calcite.

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

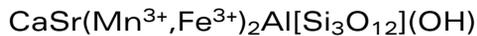
Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* megascopic color unknown. *Streak:* black. *Hardness:* could not be determined because of complex intergrowth with other minerals, but it has a polishing hardness similar to that of chrisstanleyite, greater than that of tiemannite and clausthalite, but lower than that of stibiopalladinite. *Tenacity:* brittle. *Cleavage:* not given. *Fracture:* uneven. *Density:* could not be measured, 9.13 g/cm³ (calc.). **Crystallography:** Orthorhombic, *Pm*mm, *P2₁mn* or *Pm2₁n*, *a* 7.219, *b* 16.782, *c* 6.467 Å, *V* 783.6 Å³, *Z* = 2, *a:b:c* = 0.4302:1:0.3854. *Morphology:* no forms were mentioned. *Twinning:* none observed. **X-ray powder-diffraction data:** 4.819(40)(101), 4.373(40)(130), 2.797(60)(032,122), 2.743(100)(151,231,240), 2.325(40)(052), 2.116(40)(062), 2.091(100)(261). **Optical data:** In reflected light: cream or slightly beige, weak anisotropism, weak bireflectance, nonpleochroic. *R*₁, *R*₂; ^{im}*R*₁, ^{im}*R*₂: (46.8, 51.3; 33.9, 38.3%) 470 nm, (49.4, 53.1; 35.9, 39.5%) 546 nm, (49.9, 53.25; 36.5, 39.9%) 589 nm, (48.95, 52.55; 35.7, 39.6%) 650 nm. **Chemical analytical data:** Mean of four sets of electron-microprobe data: Cu 0.2, Se 32.0, Pd 39.4, Pt 0.1, Ag 1.0, Hg 24.9, Pb 1.4, Total 99.0 wt.%. Empirical formula: (Pd_{8.05}Pt_{0.01}) Σ 8.06(Hg_{2.70}Ag_{0.20}Pb_{0.15}Cu_{0.07}) Σ 3.12Se_{8.82}. **Relationship to other species:** None apparent.

Name: After Gerhard Tischendorf (b. 1927), formerly at GeoForschungsZentrum, Potsdam, Germany, for his many contributions to mineralogy and geochemistry, and particularly his studies of the formation of selenide deposits of the Harz Mountains.

Comments: IMA No. 2001-061.

STANLEY, C.J., CRIDDLE, A.J., FÖRSTER, H.-J. & ROBERTS, A.C. (2002): Tischendorfite, Pd₈Hg₃Se₉, a new mineral species from Tilkerode, Harz Mountains, Germany. *Canadian Mineralogist* **40**, 739-745.

Tweddillite



MONOCLINIC

Locality: The Wessels mine, Kalahari manganese field, Republic of South Africa.

Occurrence: Found in calc-silicate rocks formed by hydrothermal alteration of primary sedimentary manganese ore. Associated minerals are: sérandite–pectolite and braunite.

General appearance: "Suns" of very thin (~ 0.02 mm) radiating blades (up to 0.5 mm long).

Physical, chemical and crystallographic properties: *Luster:* given as vitreous, but the optical data indicate adamantine. *Diaphaneity:* not given but probably translucent. *Color:* deep dark red. *Streak:* brownish red. *Luminescence:* not given. *Hardness:* 6 to 7. *Tenacity:* brittle. *Cleavage:* {001} perfect. *Fracture:* subconchoidal. *Density:* not measured because of strong chemical zoning, 3.89 g/cm^3 (calc.). *Crystallography:* Monoclinic, $P2_1/m$, a 8.934, b 5.718, c 10.325 Å, β 114.54°, V 479.8 Å³, $Z = 2$, $a:b:c = 1.5624:1:1.8057$. *Morphology:* {001} elongate parallel to [010]. *Twinning:* on (100). *X-ray powder-diffraction data:* 3.513(50)(21 $\bar{1}$), 2.936(100)(11 $\bar{3}$), 2.854(40)(020), 2.703(80)(300), 2.586(80)(202), 2.182(80)(40 $\bar{1}$), 2.149(40)(221). *Optical data:* Biaxial (+), average n 1.825, $2V$ could not be measured, dispersion not given; pleochroism strong, within the (001) blades dark red parallel to b and orange-yellow parallel to a , whereas perpendicular to (001), the blades appear magenta to red; orientation could not be determined. *Chemical analytical data:* Four sets of electron-microprobe data are given. The data for material with the lowest Al content (H_2O calculated): Na₂O 0.01, K₂O 0.01, CaO 9.78, SrO 18.18, BaO 0.10, PbO 1.42, Al₂O₃ 9.35, Mn₂O₃ 21.32, Fe₂O₃ 5.80, SiO₂ 32.50, H₂O (1.48), Cl 0.01, sum 99.96, less O = Cl 0.00, Total (99.96) wt.%. Empirical formula: $(\text{Ca}_{0.98}\text{Pb}_{0.04})_{\Sigma 1.02}\text{Sr}_{0.99}(\text{Mn}^{3+}_{1.52}\text{Fe}^{3+}_{0.41})_{\Sigma 1.93}\text{Al}_{1.03}[\text{Si}_{3.04}\text{O}_{12.10}](\text{OH})_{0.92}$. *Relationship to other species:* It is a member of the epidote group.

Name: After Samuel Milbourn Tweddill, FGS, first curator of the Museum of the Geological Survey, Pretoria, Republic of South Africa. He ran the museum from 1897 to 1916.

Comments: IMA No. 2001–014.

ARMBRUSTER, T., GNOS, E., DIXON, R., GUTZMER, J., HEJNY, C., DÖBELIN, N. & MEDENBACH, O. (2002): Manganvesuvianite and tweddillite, two new Mn³⁺-silicate minerals from the Kalahari manganese fields, South Africa. *Mineralogical Magazine* 66, 137-150.