

## NEW MINERALS

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### Cobalttsumcorite



MONOCLINIC

**Locality:** Am Roten Berg, Schneeberg–Neustädtel, Saxony, Germany.

**Occurrence:** Found in the oxidation zone of the deposit associated with quartz on the type specimen. Associated minerals on other samples are: Co- and Ni-bearing mawbyite, cobaltlotharmeyerite, galena, arseniosiderite and plumbogummite.

**General appearance:** Rosette-like aggregates (up to 2 mm in diameter) composed of tabular crystals up to 0.3 mm.

**Physical, chemical and crystallographic properties:** *Luster:* adamantine. *Diaphaneity:* transparent. *Color:* brown to red-brown. *Streak:* light brown. *Luminescence:* nonfluorescent. *Hardness:* VHN<sub>25</sub> 500 kg/mm<sup>2</sup>, Mohs 4½. *Tenacity:* brittle. *Cleavage:* {001} good. *Fracture:* conchoidal. *Density:* could not be measured, 5.31 g/cm<sup>3</sup> (calc.). **Crystallography:** Monoclinic, C2/m, *a* 9.097, *b* 6.313, *c* 7.555 Å, β 115.08°, *V* 393.0 Å<sup>3</sup>, *Z* = 2, *a:b:c* = 1.4410:1:1.1967. *Morphology:* {201} dominant, {001} and {111}. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 4.656(87)(111̄), 4.462(96)(201̄), 3.243(100)(112̄), 3.010(58)(201), 2.868(50)(021), 2.733(47)(311̄), 2.538(40)(112). **Optical data:** Biaxial (+), α 1.92 (calc.), β 1.94, γ 1.98, 2*V*(meas.) 70°, dispersion not determined; pleochroism strong, *X* light brown, *Y* red-brown, *Z* yellow; *X* ∧ *c* = 15° in acute angle β, *Y* = *b*, *Z* ∧ *a* = 40° in the obtuse angle β. **Chemical analytical data:** Mean of seven sets of electron-microprobe data: CaO <0.05, NiO 5.20, CoO 9.10, CuO <0.05, ZnO 0.52, PbO 34.23, Al<sub>2</sub>O<sub>3</sub> 0.29, Fe<sub>2</sub>O<sub>3</sub> 8.47, Bi<sub>2</sub>O<sub>3</sub> <0.05, P<sub>2</sub>O<sub>5</sub> 0.06, V<sub>2</sub>O<sub>5</sub> <0.05, As<sub>2</sub>O<sub>5</sub> 36.49, SO<sub>3</sub> 0.09, H<sub>2</sub>O (4.65), Total (99.10) wt.%. Empirical formula: Pb<sub>0.97</sub>(Co<sub>0.77</sub>Fe<sup>3+</sup><sub>0.67</sub>Ni<sub>0.44</sub>Zn<sub>0.04</sub>Al<sub>0.04</sub>)<sub>Σ1.96</sub> [(AsO<sub>4</sub>)<sub>2.02</sub>(SO<sub>4</sub>)<sub>0.01</sub>(PO<sub>4</sub>)<sub>0.01</sub>]<sub>Σ2.04</sub> [(H<sub>2</sub>O)<sub>1.41</sub>(OH)<sub>0.46</sub>]<sub>Σ1.87</sub>. **Relationship to other species:** It is a member of the tsumcorite group, specifically, the cobalt-dominant analogue of tsumcorite.

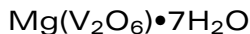
**Name:** Reflects the relationship to tsumcorite.

**Comments:** IMA No. 1999–029.

KRAUSE, W., BERNHARDT, H.-J., EFFENBERGER, H. & MARTIN, M. (2001): Cobalttsumcorite and nickellotharmeyerite, two new minerals from Schneeberg, Germany: description and crystal structure. *Neues Jahrbuch für Mineralogie, Monatshefte*, 558-576.

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# Dickthomssenite



MONOCLINIC

**Locality:** The Firefly-Pigmay mine, Sect. 30, T. 28 S, R. 26 E, 16 km east of La Sal, San Juan County, Utah, U.S.A.

**Occurrence:** A coating on sandstone that locally contains organic material, including log fragments, some of which contain uranium and vanadium mineralization. Associated minerals are: pascoite, sherwoodite, selenium, bariandite, devilline, rossite, hewettite, carnotite, clausenthalite, coffinite, tyuyamunite, uraninite, corvusite, montroseite, roscoelite, galena, pyrite and tennantite.

**General appearance:** Crystals from 0.25 mm needle-like to  $0.5 \times 1.5$  mm platy, prismatic with basal terminations. The crystals are in fibroradial groups up to 5 mm long.

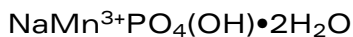
**Physical, chemical and crystallographic properties:** *Luster:* vitreous. *Diaphaneity:* translucent. *Color:* light golden brown. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 2½. *Tenacity:* brittle. *Cleavage:* {100} perfect. *Fracture:* hackly. *Density:* between 1.96 and 2.09 g/cm<sup>3</sup> (meas.), 2.04 g/cm<sup>3</sup> (calc.). **Crystallography:** Monoclinic, C2/c, *a* 38.954, *b* 7.2010, *c* 16.3465 Å,  $\beta$  97.602°, *V* 4544.0 Å<sup>3</sup>, *Z* = 16, *a:b:c* = 5.4095:1:2.2700. *Morphology:* no forms were mentioned. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 9.704(100)(400), 8.117(60)(002), 5.843(100)(400), 4.061(50)(004), 3.139(90)( $\bar{1}202$ ), 2.920(60)(804), 2.707(50)(006). **Optical data:** Biaxial (-),  $\alpha$  1.6124,  $\beta$  1.6740,  $\gamma$  1.7104, *2V*(meas.) 74°, *2V*(calc.) 73°; dispersion *r* < *v*; nonpleochroic;  $Y \wedge c = 16.5^\circ$  in acute angle  $\beta$ ,  $X \wedge a = 24.5^\circ$  in obtuse angle  $\beta$ , *Z* = *b*. **Chemical analytical data:** Electron-microprobe data were elevated owing to decomposition of the sample under the electron beam. The analytical results, with H<sub>2</sub>O calculated to give 7H<sub>2</sub>O (as indicated by the crystal-structure determination) and the oxides recalculated to give 100.00 wt.%, are: MgO 10.99, FeO 0.41, V<sub>2</sub>O<sub>5</sub> 52.43, H<sub>2</sub>O (36.17), Total (100.00) wt.%. Empirical formula: (Mg<sub>0.95</sub>Fe<sub>0.02</sub>) $\Sigma$ <sub>0.97</sub>(V<sub>2</sub>O<sub>6</sub>)•7.00H<sub>2</sub>O. **Relationship to other species:** None apparent.

**Name:** After Richard ("Dick") W. Thomssen (b. 1933), consulting geologist from Dayton, Nevada, U.S.A.

**Comments:** IMA No. 2000-047. The mineral was discovered by J. Marty. Note that the crystal structure has been determined.

HUGHES, J.M., CURETON, F.E., MARTY, J., GAULT, R.A., GUNTER, M.E., CAMPANA, C.F., RAKOVAN, J., SOMMER, A. & BRUESEKE, M.E. (2001): Dickthomssenite, Mg(V<sub>2</sub>O<sub>6</sub>)•7H<sub>2</sub>O, a new mineral species from the Firefly-Pigmay mine, Utah: descriptive mineralogy and arrangement of atoms. *Canadian Mineralogist* 39, 1691-1700.

# Ercitite



MONOCLINIC

**Locality:** The Tanco pegmatite, Bernic Lake, Manitoba, Canada.

**Occurrence:** Found in a lithiophilite nodule embedded in a quartz–spodumene pseudomorph after petalite in the upper intermediate zone (5) of a granitic pegmatite. Associated minerals are: lithiophilite, collinsite–fairfieldite, whitlockite, two unidentified phases, spodumene, quartz, cookeite, rhodochrosite, “apatite” and sphalerite.

**General appearance:** Irregular aggregates (200 to 400  $\mu\text{m}$  across) of lath-like crystals (generally  $\leq 20 \times \leq 200 \mu\text{m}$ ).

**Physical, chemical and crystallographic properties:** *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* pale brown. *Streak:* beige. *Luminescence:* not mentioned. *Hardness:* between 3 and 4. *Tenacity:* brittle. *Cleavage:* {101} and {010} very good. *Fracture:* irregular. *Density:* could not be measured, 2.77  $\text{g}/\text{cm}^3$  (calc.). **Crystallography:** Monoclinic,  $P2_1/n$ ,  $a$  5.362,  $b$  19.89,  $c$  5.362  $\text{\AA}$ ,  $\beta$  108.97°,  $V$  540.8  $\text{\AA}^3$ ,  $Z = 4$ ,  $a:b:c = 0.2696:1:0.2696$ . Morphology: {101}, elongate [101] and flattened on {101}. Twinning: none mentioned. **X-ray powder-diffraction data:** 9.9(10)(020), 4.92(5)(011,110), 3.273(6)(141), 3.126(6)(150,051), 2.644(8)(141), 2.542(4)(200,002), 2.376(4)(171). **Optical data:** Biaxial (+),  $\alpha$  1.699,  $\beta$  1.715,  $\gamma$  1.737,  $2V(\text{meas.})$  86°,  $2V(\text{calc.})$  82°; dispersion not mentioned; pleochroism strong,  $X$  yellowish green,  $Y$  yellowish brown,  $Z$  very dark brown, absorption  $Z \gg Y > X$ ;  $X = b$ ,  $Y \wedge c = 34^\circ$  (in acute angle  $\beta$ ),  $Z \wedge a = 53^\circ$  (in obtuse angle  $\beta$ ). **Chemical analytical data:** Mean of four sets of electron-microprobe data:  $\text{Na}_2\text{O}$  12.44,  $\text{MgO}$  0.12,  $\text{CaO}$  1.09,  $\text{ZnO}$  0.08,  $\text{Al}_2\text{O}_3$  0.34,  $\text{Fe}_2\text{O}_3$  16.51,  $\text{Mn}_2\text{O}_3$  18.81,  $\text{P}_2\text{O}_5$  32.37,  $\text{H}_2\text{O}$  (20.44), Total (102.20) wt.%.  $\text{H}_2\text{O}$  was calculated to give  $2\text{H}_2\text{O} + 1(\text{OH})$ , as indicated by the crystal-structure results. Empirical formula:  $(\text{Na}_{0.88}\text{Ca}_{0.04})_{\Sigma 0.92}(\text{Mn}^{3+}_{0.53}\text{Fe}^{3+}_{0.46}\text{Mg}_{0.01})_{\Sigma 1.00}(\text{PO}_4)_{1.00}(\text{OH})_{1.00}\cdot 2.00\text{H}_2\text{O}$ . **Relationship to other species:** It is structurally related to bermanite,  $\text{Mn}^{2+}\text{Mn}^{3+}_2(\text{PO}_4)_2(\text{OH})_2\cdot 4\text{H}_2\text{O}$ , and to tsumcorite,  $\text{Pb}^{2+}(\text{Zn},\text{Fe}^{3+})_2(\text{AsO}_4)_2(\text{OH},\text{H}_2\text{O})$ .

**Name:** After T. Scott Ercit (b. 1957), Canadian Museum of Nature, an eminent student of the mineralogy of granitic pegmatites.

**Comments:** IMA No. 1999–036.

FRANSOLET, A.-M., COOPER, M.A., ČERNÝ, P., HAWTHORNE, F.C., CHAPMAN, R. & GRICE, J.D. (2000): The Tanco pegmatite at Bernic Lake, southeastern Manitoba. XV. Ercitite,  $\text{NaMn}^{3+}\text{PO}_4(\text{OH})(\text{H}_2\text{O})_2$ , a new phosphate mineral species. *Canadian Mineralogist* 38, 893–898.

# Felbertalite



MONOCLINIC

**Locality:** The Felbertal scheelite deposit, Felbertal, Salzburg Province, Austria.

**Occurrence:** It is a minor to trace constituent in laminated discordant quartz veins that contain scheelite, pyrite, pyrrhotite and chalcopyrite. Locally, associated sulfosalt minerals are: galenobismutite, cosalite, members of the bismuthinite–aikinite series (krupkaite–lindströmite range and gladite–hammarite range), argentian lillianite, Se-free junosite and members of the pavonite homologous series. Felbertalite is invariably intimately intergrown with argentian lillianite and, rarely, with cannizzarite, Se-free junosite, Se-free proudite, bismuthinite derivatives and cosalite.

**General appearance:** Elongate crystals (up to 0.5 mm).

**Physical, chemical and crystallographic properties:** *Luster:* metallic. *Diaphaneity:* opaque. *Color:* bright white, very similar to the color of the associated sulfosalts, from which it is indistinguishable. *Streak:* grayish black. *Hardness:* VHN<sub>25</sub> 206 kg/mm<sup>2</sup>, Mohs about 3½. *Tenacity:* brittle. *Cleavage:* {001} perfect. *Fracture:* uneven. *Density:* could not be measured, 6.88 g/cm<sup>3</sup> (calc.) (given as 6.95 g/cm<sup>3</sup>). **Crystallography:** Monoclinic, C2/m, *a* 27.637, *b* 4.0499, *c* 20.741 Å, β 131.258°, *V* 1745.1 Å<sup>3</sup>, *Z* = 2, *a:b:c* = 6.8241:1:5.1214. *Morphology:* no forms were mentioned. *Twinning:* none observed. **X-ray powder-diffraction data:** 3.78(S)(203), 3.51(S)(31 $\bar{3}$ ), 3.38(S)(40 $\bar{6}$ ), 2.320(S)(11 $\bar{6}$ ), 2.096(S)(11.1. $\bar{7}$ ), 2.062(S)(11 $\bar{7}$ ), 2.031(S)(020), 1.744(S)(62 $\bar{6}$ ), 2.918(S)(510), 1.791(S)(223). **Optical data:** In reflected light: white, distinct anisotropism, perceptible bireflectance in air (a little more in oil), slightly pleochroic in grayish white and creamy white. *R*<sub>1</sub>, *R*<sub>2</sub>; <sup>im</sup>*R*<sub>1</sub>, <sup>im</sup>*R*<sub>2</sub>: (42.70, 46.10; 27.40, 29.55%) 470 nm, (40.65, 44.30; 25.50, 27.40%) 546 nm, (39.50, 43.20; 24.65, 26.60%) 589 nm, (38.90, 43.10; 23.95, 25.90%) 650 nm. **Chemical analytical data:** Mean of seven sets of electron-microprobe data: Cu 3.56, Ag 1.10, Cd 0.43, Pb 29.9, Bi 48.3, Te 0.21, S 16.8, Total 100.30 wt.% (given as 100.4). Empirical formula: Cu<sub>2.02</sub>Ag<sub>0.37</sub>Cd<sub>0.14</sub>Pb<sub>5.20</sub>Bi<sub>8.33</sub>Te<sub>0.06</sub>S<sub>18.89</sub>. **Relationship to other species:** It is a homologue of junosite.

**Name:** After the locality.

**Comments:** IMA No. 1999-042. The structure has been solved.

TOPA, D., MAKOVICKY, E., CRIDDLE, A.J., PAAR, W.H. & BALIĆ-ŽUNIĆ, T. (2001): Felbertalite, Cu<sub>2</sub>Pb<sub>6</sub>Bi<sub>8</sub>S<sub>19</sub>, a new mineral species from Felbertal, Salzburg Province, Austria. *European Journal of Mineralogy* **13**, 961-972.

TOPA, D., MAKOVICKY, E., BALIĆ-ŽUNIĆ, T. & BERLEPSCH, P. (2000): The crystal structure of Cu<sub>2</sub>Pb<sub>6</sub>Bi<sub>8</sub>S<sub>19</sub>. *European Journal of Mineralogy* **12**, 825-833.

# Florenskyite



ORTHORHOMBIC

**Locality:** The Kaidun meteorite, South Yemen.

**Occurrence:** Found in a chondritic meteorite. Associated minerals are: ferroan serpentine, pentlandite and an uncharacterized Fe–Cr phosphide.

**General appearance:** Four dispersed grains (up to 14  $\mu\text{m}$ ).

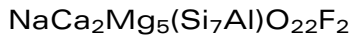
**Physical, chemical and crystallographic properties:** *Luster:* metallic. *Diaphaneity:* opaque. *Color:* Megascopic color unknown. *Streak:* not given. *Hardness:* not given. *Tenacity:* not given. *Cleavage:* not given. *Fracture:* not given. *Density:* could not be measured; calculated density not given but was calculated here as 6.08 g/cm<sup>3</sup> (calc.). **Crystallography:** Orthorhombic, *Pnma*, *a* 6.007, *b* 3.602, *c* 6.897 Å, *V* 149.23 Å<sup>3</sup>, *Z* = 4, *a:b:c* = 1.6677:1:1.9148. *Morphology:* no forms were observed. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 2.307(47)(210), 2.301(100)(112), 2.188(88)(211), 2.147(31)(103), 1.938(45)(013), 1.923(34)(301), 1.801(45)(020), 1.115(38)(230). The pattern was calculated from structural data. **Optical data:** In reflected light: creamy white. Other optical properties could not be determined. **Chemical analytical data:** Mean of three sets of electron-microprobe data: Ti 30.08, Cr 0.93, Fe 40.52, Co 0.60, Ni 5.47, V 0.91, Si 0.59, P 21.69, Total 100.79 wt.%. Empirical formula:  $(\text{Fe}_{0.98}\text{Ni}_{0.13}\text{Co}_{0.01})_{\Sigma 1.12}(\text{Ti}_{0.85}\text{Cr}_{0.02}\text{V}_{0.02})_{\Sigma 0.89}(\text{P}_{0.95}\text{Si}_{0.03})_{\Sigma 0.98}$ . **Relationship to other species:** One of the four known natural phosphides (see Comments).

**Name:** After Cyrill P. Florensky (1915–1982), Russian geochemist and one of the founders of planetology.

**Comments:** IMA No. 1999–013. The authors state that there are three other natural phosphides: schreibersite,  $(\text{Fe,Ni})_3\text{P}$ , barringerite,  $(\text{Fe,Ni})_2\text{P}$ , and perryite,  $(\text{Ni,Fe})_8(\text{Si,P})_3$ . However, strictly speaking, perryite cannot be considered a phosphide because the phosphorus is not dominant. There is another phosphide not mentioned by the authors: nickelphosphide,  $(\text{Ni,Fe})_3\text{P}$ , described in 1999 (see abstract in *The Canadian Mineralogist, Special Publication 4*, 169). Florenskyite has the anti- $\text{PbCl}_3$  structure and is isostructural with synthetic  $\text{FeZrP}$ .

IVANOV, A.V., ZOLENSKY, M.E., SAITO, A., OHSUMI, K., YANG, S.V., KONONKOVA, N.N. & MIKOUCHI, T. (2000): Florenskyite,  $\text{FeTiP}$ , a new phosphide from the Kaidun meteorite. *American Mineralogist* 85, 1082–1086.

## Fluoro-edenite



MONOCLINIC

**Locality:** Near Biancavilla, Catania, Sicily, Italy.

**Occurrence:** In autoclasts of gray-red altered benmoreitic lavas. Associated minerals are: microgranular K-feldspar and plagioclase, quartz, clinopyroxenes, orthopyroxenes, fluorapatite, ilmenite and hematite.

**General appearance:** Prismatic to acicular crystals (up to 2 mm long), commonly in parallel bundles.

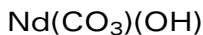
**Physical, chemical and crystallographic properties:** *Luster:* vitreous to resinous. *Diaphaneity:* transparent. *Color:* intense yellow. *Streak:* white-yellow. *Luminescence:* nonfluorescent. *Hardness:* 5 to 6. *Tenacity:* not mentioned, but probably brittle. *Cleavage:* {110} perfect. *Fracture:* conchoidal. *Density:* 3.09 g/cm<sup>3</sup> (calc.). *Crystallography:* Monoclinic, *P2/m*, *a* 9.847, *b* 18.017, *c* 5.268 Å, β 104.84°, *V* 903.45 Å<sup>3</sup>, *Z* = 2, *a:b:c* = 0.5465:1:0.2924. *Morphology:* no forms were mentioned. *Twinning:* none mentioned. *X-ray powder-diffraction data:* 8.403(57)(110), 3.376(13)(131), 3.271(48)(240), 3.125(100)(310), 2.938(17)(221), 2.807(33)(330), 2.703(25)(151), 1.8939(18)(510), 1.6489(14)(461), 1.4384(14)(661). *Optical data:* Biaxial (-), α 1.6058, β 1.6170, γ 1.6245, *2V* not measured, *2V*(calc.) 78°, dispersion not given; pleochroism not visible; *Y = b*, *Z* ∧ *c* = 26° (in obtuse angle β), *X* ∧ *a* = 11° (in acute angle β). *Chemical analytical data:* Mean of three sets of electron-microprobe data: Na<sub>2</sub>O 3.20, K<sub>2</sub>O 0.84, MgO 22.65, CaO 10.83, MnO 0.46, FeO 1.60, Al<sub>2</sub>O<sub>3</sub> 3.53, Fe<sub>2</sub>O<sub>3</sub> 1.00, SiO<sub>2</sub> 52.92, TiO<sub>2</sub> 0.29, F 4.35, Cl 0.07, sum 101.74, less O = F + Cl 1.85, Total 99.89 wt.%. Empirical formula: (Na<sub>0.61</sub>K<sub>0.15</sub>)Σ0.76 (Na<sub>0.26</sub>Ca<sub>1.63</sub>Mg<sub>0.06</sub>Mn<sub>0.05</sub>)Σ2.00 (Mg<sub>4.67</sub>Fe<sup>2+</sup><sub>0.19</sub>Fe<sup>3+</sup><sub>0.11</sub>Ti<sub>0.03</sub>)Σ5.00 (Si<sub>7.41</sub>Al<sub>0.58</sub>)Σ7.99O<sub>22.00</sub> (F<sub>1.93</sub>O<sub>0.05</sub>Cl<sub>0.02</sub>)Σ2.00. *Relationship to other species:* A member of the amphibole group.

**Name:** Complies with the amphibole classification approved by the IMA.

**Comments:** IMA No. 2000-049.

GIANFAGNA, A. & OBERTI, R. (2001): Fluoro-edenite from Biancavilla (Catania, Sicily, Italy): crystal chemistry of a new amphibole end-member. *American Mineralogist* **86**, 1489-1493.

# Kozoite-(Nd)



ORTHORHOMBIC

**Locality:** Niikoba, Hizen-cho, Higashi Matsuura-gun, Saga Prefecture, Japan.

**Occurrence:** Found in cavities and fissures in an alkali olivine basalt. Associated minerals are: lanthanite-(Nd) or lanthanite-(La) or both, amorphous silica of "hyalite" type, and kimuraite-(Y).

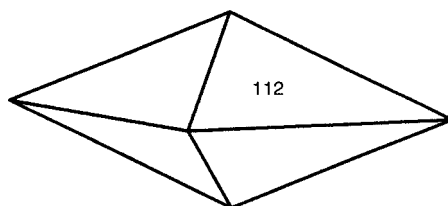
**General appearance:** Rhombic bipyramidal crystals (up to 10  $\mu\text{m}$ ).

**Physical, chemical and crystallographic properties:** *Luster:* vitreous to dull. *Diaphaneity:* not given. *Color:* pale pinkish purple to white. *Streak:* not given. *Luminescence:* nonfluorescent. *Hardness:* could not be determined. *Tenacity:* not given. *Cleavage:* could not be determined. *Fracture:* not given. *Density:* could not be measured, 4.40  $\text{g}/\text{cm}^3$  (calc.). See Comments. **Crystallography:** Orthorhombic, *Pm*cn, *a* 4.9829, *b* 8.5188, *c* 7.2570  $\text{\AA}$ , *V* 308.05  $\text{\AA}^3$ , *Z* = 4, *a:b:c* = 0.5849:1:0.8519. Morphology: no forms were mentioned, but the form on the crystals shown in the SEM image probably is {112}. Twinning: none mentioned. **X-ray powder-diffraction data:** 4.29(100)(110), 3.69(72)(111), 2.93(89)(102), 2.640(59)(031), 2.333(78)(131), 2.060(78)(221), 1.994(75)(212). **Optical data:** Biaxial (sign unknown),  $\alpha$  1.698,  $\gamma$  1.780, high birefringence, 2*V* not measured, no other properties could be determined. **Chemical analytical data:** Mean of six sets of electron-microprobe data: CaO 0.49, La<sub>2</sub>O<sub>3</sub> 21.39, Ce<sub>2</sub>O<sub>3</sub> 0.26, Pr<sub>2</sub>O<sub>3</sub> 6.25, Nd<sub>2</sub>O<sub>3</sub> 30.66, Sm<sub>2</sub>O<sub>3</sub> 5.39, Eu<sub>2</sub>O<sub>3</sub> 1.84, Gd<sub>2</sub>O<sub>3</sub> 2.99, Tb<sub>2</sub>O<sub>3</sub> 0.11, Dy<sub>2</sub>O<sub>3</sub> 0.24, Y<sub>2</sub>O<sub>3</sub> 0.70, CO<sub>2</sub> 21.10, H<sub>2</sub>O 5.44, Total 96.86 wt.%. CO<sub>2</sub> and H<sub>2</sub>O by CHN analyzer for C and H. Empirical formula: (Nd<sub>0.38</sub>La<sub>0.28</sub>Pr<sub>0.08</sub>Sm<sub>0.07</sub>Gd<sub>0.03</sub>Eu<sub>0.02</sub>Ca<sub>0.02</sub>Y<sub>0.01</sub>) $\Sigma$ 0.89(CO<sub>3</sub>)<sub>1.01</sub>(OH)<sub>0.63</sub>(H<sub>2</sub>O)<sub>0.32</sub>. **Relationship to other species:** Kozoite-(Nd) has a dimorphic relationship with hydroxylbastnäsite-(Nd) and is isostructural with ancylite-(Ce), calcio-ancylite-(Ce), calcio-ancylite-(Nd), ancylite-(La) and gysinite-(Nd).

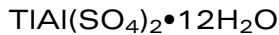
**Name:** After Kozo Nagashima (1925–1985), chemist and pioneer in the study of the chemistry of rare-earth minerals in Japan, in recognition of his contributions to the mineralogy, chemistry and crystallography of rare-earth minerals.

**Comments:** IMA No. 1998-063. The authors give the calculated density as 4.77  $\text{g}/\text{cm}^3$ ; this is the value based on the ideal composition. The value 4.40  $\text{g}/\text{cm}^3$  given above is for the empirical formula. The crystal drawing given here is based on the SEM image.

MIYAWAKI, R., MATSUBARA, S. YOKOYAMA, K., TAKEUCHI, K., TERADA, Y. & NAKAI, I. (2000): Kozoite-(Nd), Nd(CO<sub>3</sub>)(OH), a new mineral in an alkali olivine basalt from Hizen-cho, Saga Prefecture, Japan. *American Mineralogist* 85, 1076-1081.



# Lanmuchangite



CUBIC

**Locality:** Lanmuchang thallium (mercury) deposit, Xinren County, Guizhou Province, People's Republic of China (Lat. 25° 31' 28" N, Long. 105° 30' 30" W).

**Occurrence:** In the oxidation zone. Associated minerals are: melanterite, pickeringite, potassium alum, jarosite, gypsum, arsenolite, sulfur and some unknown minerals.

**General appearance:** Anhydral granular crystals (40 to 90  $\mu\text{m}$ ) in aggregates 2 to 10 mm across. Occasionally in parallel columnar form consisting of subhedral to euhedral columnar crystals 15 to 65  $\mu\text{m}$  in diameter.

**Physical, chemical and crystallographic properties:** *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* yellow to white. *Streak:* white. *Luminescence:* not given. *Hardness:* VHN 94–124  $\text{kg}/\text{mm}^2$ , Mohs 3 to 3½. *Tenacity:* brittle. *Cleavage:* not given. *Fracture:* not given. *Density:* 2.22  $\text{g}/\text{cm}^3$  (meas.), 2.35  $\text{g}/\text{cm}^3$  (calc.). *Other properties:* soluble in water. **Crystallography:** Cubic,  $Pa\bar{3}$ ,  $a$  12.212 Å,  $V$  1821 Å<sup>3</sup>,  $Z = 4$ . Morphology: no forms were mentioned. Twinning: none mentioned. **X-ray powder-diffraction data:** 7.03(54)(111), 6.11(27)(200), 4.314(100)(220), 3.524(24)(222), 2.801(70)(331), 2.731(35)(420). **Optical data:** Isotropic,  $n$  1.495. **Chemical analytical data:** Mean of six sets of electron-microprobe data ( $\text{H}_2\text{O}$  by TGA):  $\text{Tl}_2\text{O}$  33.25,  $\text{Na}_2\text{O}$  0.00,  $\text{K}_2\text{O}$  0.35,  $\text{MgO}$  0.06,  $\text{CaO}$  0.08,  $\text{FeO}$  0.04,  $\text{Al}_2\text{O}_3$  8.07,  $\text{SiO}_2$  0.10,  $\text{SO}_3$  25.19,  $\text{H}_2\text{O}$  33.46, Total 100.60 wt.%. Empirical formula:  $(\text{Tl}_{1.00}\text{K}_{0.05})_{\Sigma 1.05}(\text{Al}_{1.01}\text{Si}_{0.01}\text{Mg}_{0.01}\text{Ca}_{0.01})_{\Sigma 1.04}(\text{SO}_4)_{2.01} \cdot 11.88\text{H}_2\text{O}$ . **Relationship to other species:** It is the Tl–Al-dominant member of the alum group.

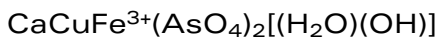
**Name:** After the locality.

**Comments:** IMA No. 2001–018.

CHEN DAIYAN, WANG GUANXIN, ZOU ZHENXI & CHEN YUMING (2001): A new mineral – lanmuchangite. *Acta Mineralogica Sinica* 21, 271–277 (in Chinese with an English abstract).



## Lukrahnite



TRICLINIC

**Locality:** Tsumeb, Namibia. Probably also from the Pucher Shaft, Schneeberg, Saxony, Germany.

**Occurrence:** Associated minerals are: beudantite, cuprian adamite, conichalcite, wulfenite, quartz and chalcocite. The mineral from the Saxony locality is associated with bismuthian nickellotharmeyerite.

**General appearance:** Spherical aggregates (up to 0.5 mm); from the Saxony locality, tiny overgrowths <10 μm thick.

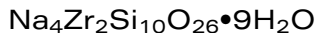
**Physical, chemical and crystallographic properties:** *Luster:* dull to subadamantine. *Diaphaneity:* transparent. *Color:* yellow. *Streak:* light yellow. *Luminescence:* nonfluorescent. *Hardness:* VHN<sub>25</sub> 630 kg/mm<sup>2</sup>, Mohs 5. *Tenacity:* brittle. *Cleavage:* none observed. *Fracture:* not given. *Density:* could not be measured, 4.18 g/cm<sup>3</sup> (calc.). **Crystallography:** Triclinic, *P*1̄ (by analogy with gartrellite), *a* 5.457, *b* 5.539, *c* 7.399 Å, α 68.43°, β 68.90°, γ 69.44°, *V* 187.8 Å<sup>3</sup>, *Z* = 1, *a:b:c* = 0.9852:1:1.3358. *Morphology:* no forms were observed. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 4.953(22)(010, 100), 4.444(20)(111), 3.416(100)(112), 3.186(40)(012,102), 2.927(64)(111̄), 2.832(26)(111̄,111̄), 2.700(30)(211), 2.533(30)(201,212), 2.468(25)(020,012,102̄, 200,113). **Optical data:** Biaxial (+), α 1.83, β 1.834 (calc.), γ 1.89, 2*V*(meas.) 30°; dispersion could not be determined; pleochroism moderate, *X* yellow, *Y* = *Z* pale yellow; orientation could not be determined. **Chemical analytical data:** Mean of nine sets of electron-microprobe data (with H<sub>2</sub>O calculated to give OH + H<sub>2</sub>O = 2): CaO 11.42, NiO 0.05, CoO 0.15, CuO 10.00, ZnO 8.19, PbO 0.69, Al<sub>2</sub>O<sub>3</sub> 0.37, Fe<sub>2</sub>O<sub>3</sub> 13.75, P<sub>2</sub>O<sub>5</sub> 0.16, As<sub>2</sub>O<sub>5</sub> 47.72, SO<sub>3</sub> 0.09, H<sub>2</sub>O (6.21), Total (98.80) wt.%. Empirical formula: (Ca<sub>0.97</sub>Pb<sub>0.01</sub>Co<sub>0.01</sub>)<sub>Σ0.99</sub>(Cu<sub>0.60</sub>Zn<sub>0.48</sub>)<sub>Σ1.08</sub>(Fe<sup>3+</sup><sub>0.82</sub>Al<sub>0.03</sub>)<sub>Σ0.85</sub>[(AsO<sub>4</sub>)<sub>1.98</sub>(PO<sub>4</sub>)<sub>0.01</sub>(SO<sub>4</sub>)<sub>0.01</sub>]<sub>Σ2.00</sub>[(H<sub>2</sub>O)<sub>1.30</sub>(OH)<sub>0.70</sub>]<sub>Σ2.00</sub>. **Relationship to other species:** It is the Ca-dominant analogue of gartrellite.

**Name:** After Ludger Krahn (b. 1957), who provided the first specimen of the mineral for investigation.

**Comments:** IMA No. 1999-030. A slightly different calculated value for H<sub>2</sub>O is given here.

KRAUSE, W., BLASS, G., BERNHARDT, H.-J. & EFFENBERGER, H. (2001): Lukrahnite, CaCuFe<sup>3+</sup>(AsO<sub>4</sub>)<sub>2</sub>[(H<sub>2</sub>O)(OH)], the calcium analogue of gartrellite. *Neues Jahrbuch für Mineralogie, Monatshefte*, 481-492.

# Natrolemoynite



MONOCLINIC

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

**Occurrence:** In pegmatites cutting nepheline syenite. Associated minerals in altered pegmatites are: microcline, lemoynite, lepidocrocite, galena, sphalerite, calcite and pyrite. Associated minerals in unaltered pegmatites are: biotite, microcline, albite, magnetite, a chlorite-group mineral, a burbankite-group mineral, an unidentified donnayite-(Y)-like mineral, zircon and pyrochlore.

**General appearance:** Bladed to prismatic crystals (up to  $1 \times 2$  mm); typically in compact radial aggregates and spheres up to 4 mm in diameter.

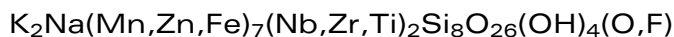
**Physical, chemical and crystallographic properties:** *Luster:* vitreous to subadamantine. *Diaphaneity:* transparent to translucent. *Color:* colorless to white; may have a slightly pink to red tinge. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 3. *Tenacity:* brittle. *Cleavage:* {100} and {010} perfect, {001} poor. *Fracture:* uneven. *Density:* 2.47 g/cm<sup>3</sup> (meas.), 2.50 g/cm<sup>3</sup> (calc.). *Crystallography:* Monoclinic, C2/m, *a* 10.5150, *b* 16.2534, *c* 9.1029 Å,  $\beta$  105.462°, *V* 1499.4 Å<sup>3</sup>, *Z* = 2, *a:b:c* = 0.6469:1:0.5601. *Morphology:* {100}, {010} and {001} dominant; also minor unidentified pinacoid-like forms. *Twinning:* none mentioned. *X-ray powder-diffraction data:* 8.832(30)(001), 8.132(100)(020), 5.975(40)(021), 3.974(35)(201), 3.693(30)(041), 3.564(40)(221), 3.490(35)( $\bar{2}22$ ), 2.804(30)( $\bar{2}42$ ). *Optical data:* Biaxial (-),  $\alpha$  1.533,  $\beta$  1.559,  $\gamma$  1.567,  $2V$ (meas.) 63°,  $2V$ (calc.) 57°; dispersion: crossed axial plane, weak; nonpleochroic;  $X = b$ ,  $Y \wedge c = 25.5^\circ$  in acute angle  $\beta$ ,  $Z \wedge a = 41^\circ$  in obtuse angle  $\beta$ . *Chemical analytical data:* Mean of nineteen sets of electron-microprobe data (with H<sub>2</sub>O calculated to give 9H<sub>2</sub>O; presence confirmed by IR and structure determination): Na<sub>2</sub>O 7.47, K<sub>2</sub>O 1.29, CaO 0.37, MnO 0.12, Al<sub>2</sub>O<sub>3</sub> 0.04, SiO<sub>2</sub> 54.51, TiO<sub>2</sub> 0.38, ZrO<sub>2</sub> 21.97, H<sub>2</sub>O (14.72), Total (101.88) wt.%. Empirical formula: (Na<sub>2.67</sub>K<sub>0.30</sub>Ca<sub>0.07</sub>Mn<sub>0.02</sub>) $\Sigma$ 3.06(Zr<sub>1.97</sub>Nb<sub>0.08</sub>Ti<sub>0.05</sub>) $\Sigma$ 2.10(Si<sub>10.05</sub>Al<sub>0.01</sub>) $\Sigma$ 10.06O<sub>25.96</sub>•9.04H<sub>2</sub>O. *Relationship to other species:* It is chemically and structurally related to lemoynite, (Na,K)<sub>2</sub>CaZr<sub>2</sub>Si<sub>10</sub>O<sub>26</sub>•5–6H<sub>2</sub>O, and altsite, Na<sub>3</sub>K<sub>6</sub>Ti<sub>2</sub>Al<sub>2</sub>Si<sub>8</sub>O<sub>26</sub>Cl<sub>3</sub>.

**Name:** Expresses the relationship with lemoynite.

**Comments:** IMA No. 1996–063. The crystal structure has been solved.

MCDONALD, A.M. & CHAO, G.Y. (2001): Natrolemoynite, a new hydrated sodium zirconosilicate from Mont Saint-Hilaire, Quebec: description and structure determination. *Canadian Mineralogist* 39, 1295–1306.

## Niobokupletskite



TRICLINIC

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

**Occurrence:** In nepheline syenite pegmatites. There are three distinct types of material, each with its own suite of associated minerals. Type I: kupletskite, aegirine, albite, microcline and pyrochlore. Type II: kupletskite, aegirine, albite, calcio-ancylite-(Ce), catapleiite, microcline, natrolite, pyrochlore and rhodochrosite. Type III: kupletskite, aegirine, albite, analcime, calcio-ancylite-(Ce), calcite, catapleiite, epididymite, fluorite, genthelvite, microcline, natrolite, pyrochlore, rhodochrosite and wurtzite.

**General appearance:** Type I: anhedral to subhedral, platy to tabular epitaxial growths on kupletskite. Type II: dense, fibrous overgrowth on kupletskite. Type III: very fine-grained acicular crystals in sheaf-like aggregates (originally described as "witch's broom astrophyllite"). Size varies from zones up to 0.5 mm, grains up to 1 mm in diameter and aggregates  $5.0 \times 2.0$  mm of acicular crystals  $1.0 \times 0.05$  mm.

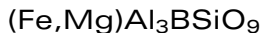
**Physical, chemical and crystallographic properties:** *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* light beige to yellow (Type I), light yellow-brown (Type II), bronze to silvery brown (Type III). *Streak:* light brown. *Luminescence:* nonfluorescent. *Hardness:* 3 to 4. *Tenacity:* brittle. *Cleavage:* {001} perfect. *Fracture:* uneven to splintery. *Density:* greater than  $3.325 \text{ g/cm}^3$  (meas.),  $3.46 \text{ g/cm}^3$  (calc.). **Crystallography:** Triclinic,  $P\bar{1}$ ,  $a$  5.4303,  $b$  11.924,  $c$  11.747 Å,  $\alpha$  112.927°,  $\beta$  94.750°,  $\gamma$  103.175°,  $V$  669.5 Å<sup>3</sup>,  $Z = 1$ ,  $a:b:c = 0.4554:1:0.9852$ . Morphology: no forms were mentioned. Twinning: none mentioned. **X-ray powder-diffraction data:** 10.707(100)(001), 4.405(20)( $\bar{1}\bar{1}1$ ), 3.536(50)(003), 3.294(20)( $\bar{1}\bar{1}3$ ), 2.793(40)( $\bar{1}\bar{3}1$ ), 2.677(30)( $\bar{2}11$ ), 2.587(40)(130), 2.503(20)( $\bar{2}12$ ). **Optical data:** Biaxial (+),  $\alpha$  1.718,  $\beta$  1.733,  $\gamma$ (calc.) 1.750,  $2V$ (meas.) 87°; pleochroism  $X \approx Y$  light orange-yellow,  $Z$  red-brown;  $X$  and  $Y$  in the (001) plane,  $Z = c$ . **Chemical analytical data:** Analytical data for all three types are given. Mean of three sets of electron-microprobe data for Type I: Na<sub>2</sub>O 2.62, K<sub>2</sub>O 5.97, Rb<sub>2</sub>O 0.82, Cs<sub>2</sub>O 0.12, MgO 0.15, MnO 26.37, FeO 2.64, ZnO 4.08, Al<sub>2</sub>O<sub>3</sub> 1.14, SiO<sub>2</sub> 31.85, TiO<sub>2</sub> 1.34, ZrO<sub>2</sub> 3.43, Nb<sub>2</sub>O<sub>5</sub> 12.13, Ta<sub>2</sub>O<sub>5</sub> 0.63, H<sub>2</sub>O 2.48, F 0.14, sum 95.91, less O = F 0.06, Total 95.85 wt.%. Empirical formula:  $(\text{K}_{1.84}\text{Rb}_{0.13}\text{Cs}_{0.01})_{\Sigma 1.98}\text{Na}_{0.95}(\text{Mn}_{5.40}\text{Zn}_{0.73}\text{Fe}_{0.53}\text{Na}_{0.28}\text{Mg}_{0.05})_{\Sigma 6.99}(\text{Nb}_{1.33}\text{Zr}_{0.40}\text{Ta}_{0.04})_{\Sigma 2.01}(\text{Si}_{7.71}\text{Al}_{0.33})_{\Sigma 8.03}\text{O}_{26.00}(\text{OH})_{4.00}(\text{O}_{0.89}\text{F}_{0.11})_{\Sigma 1.00}$ . **Relationship to other species:** It is a member of the astrophyllite group, specifically the K-Mn-Nb-dominant member.

**Name:** Expresses the relationship to kupletskite.

**Comments:** IMA No. 1999-032.

PIILONEN, P.C., LALONDE, A.E., McDONALD, A.M & GAULT, R.A (2000): Niobokupletskite, a new astrophyllite-group mineral from Mont Saint-Hilaire, Quebec, Canada: description and crystal structure. *Canadian Mineralogist* **38**, 627-639.

# Ominelite



ORTHORHOMBIC

**Locality:** Along the Misen River, Misen pluton, Omine Mountains, Nara Prefecture, Japan.

**Occurrence:** In a porphyritic granite and granodiorite. Associated minerals are: alkali feldspar, plagioclase, quartz, sekaninaite, andalusite, topaz, garnet, biotite, muscovite, dumortierite, schorl, zircon, "apatite", "monazite", ilmenite, pyrite, cordierite, "sericite" and a chlorite-group mineral.

**General appearance:** Elongate and euhedral to equant and anhedral grains (up to 0.5 mm long).

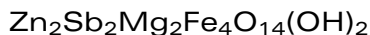
**Physical, chemical and crystallographic properties:** *Luster:* vitreous. *Diaphaneity:* not mentioned but probably transparent to translucent. *Color:* blue. *Streak:* pale blue. *Luminescence:* none mentioned. *Hardness:* about 7. *Tenacity:* not given but probably brittle. *Cleavage:* none. *Fracture:* not given. *Density:* not measured, 3.20 g/cm<sup>3</sup> (calc.); given as 3.169 g/cm<sup>3</sup>. *Crystallography:* Orthorhombic, *Pbnm*, *a* 10.343, *b* 11.095, *c* 5.7601 Å, *V* 661.0 Å<sup>3</sup>, *Z* = 4, *a:b:c* = 0.9322:1:0.5192. Morphology: no forms were mentioned. Twinning: none mentioned. *X-ray powder-diffraction data:* 5.21(vs)(200), 5.05(vvs)(101), 2.97(s)(301), 2.79(s)(040), 2.18(s)(150,421,312). *Optical data:* Biaxial (-),  $\alpha$  1.631,  $\beta$  1.654,  $\gamma$  1.656,  $2V(\text{meas.})$  31.5°,  $2V(\text{calc.})$  32°; dispersion  $v \gg r$ , strong; pleochroism X pale blue-green, Y colorless, Z pale blue-green; orientation, *Y* = *c*. **Chemical analytical data:** Mean of five sets of electron-microprobe data: MgO 1.20, CaO -, MnO 0.44, FeO 21.05, ZnO 0.20, B<sub>2</sub>O<sub>3</sub> 10.69, Al<sub>2</sub>O<sub>3</sub> 47.98, SiO<sub>2</sub> 19.22, P<sub>2</sub>O<sub>5</sub> 0.21, F -, Total 100.99 wt.%. Empirical formula: (Fe<sub>0.92</sub>Mg<sub>0.09</sub>Mn<sub>0.02</sub>Zn<sub>0.01</sub>) $\Sigma$ 1.04Al<sub>2.97</sub>B<sub>0.97</sub>(Si<sub>1.01</sub>P<sub>0.01</sub>) $\Sigma$ 1.02O<sub>9.00</sub>. Two other sets of analytical data are given. **Relationship to other species:** It is the Fe<sup>2+</sup>-dominant analogue of grandidierite, (Mg,Fe<sup>2+</sup>)Al<sub>3</sub>BSiO<sub>9</sub>.

**Name:** After the Omine Mountains.

**Comments:** IMA No. 1999-025.

HIROI, Y., GREW, E.S., MOTOYOSHI, Y., PEACOR, D.R., ROUSE, R.C., MATSUBARA, S., YOKOYAMA, K., MIYAWAKI, R., MCGEE, J.J., SU, SHU-CHUN, HOKADA, T., FURUKAWA, N. & SHIBASAKI, H. (2002): Ominelite, (Fe,Mg)Al<sub>3</sub>BSiO<sub>9</sub> (Fe<sup>2+</sup> analogue of grandidierite), a new mineral from porphyritic granite in Japan. *American Mineralogist* 87, 160-170.

# Rinmanite




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 HEXAGONAL
 

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**Locality:** The Garpenberg Norra zinc–lead mine, Hedemora, Dalarna, south-central Sweden.

**Occurrence:** Found in a skarn assemblage within dolomite marble. Associated minerals are: dolomite, calcite, manganian tremolite, zincian manganocummingtonite, manganian talc, franklinite, barite and svabite.

**General appearance:** Euhedral prismatic crystals (up to about 0.5 mm).

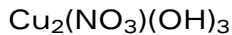
**Physical, chemical and crystallographic properties:** *Luster:* submetallic. *Diaphaneity:* opaque. *Color:* black. *Streak:* brown. *Hardness:* VHN<sub>100</sub> 880 kg/mm<sup>2</sup>, Mohs about 6. *Tenacity:* not given. *Cleavage:* {100} well developed. *Fracture:* splintery. *Density:* could not be measured, 5.11 g/cm<sup>3</sup> (calc.). *Crystallography:* Hexagonal, *P6<sub>3</sub>mc*, *a* 5.9889, *c* 9.353 Å, *V* 290.53 Å<sup>3</sup>, *Z* = 1, *c:a* = 1.5617. *Morphology:* no forms were mentioned. *Twinning:* none mentioned. *X-ray powder-diffraction data:* 3.474(34)(102), 2.994(43)(110), 2.673(44)(103), 2.522(100)(112), 1.6597(28)(213), 1.5170(33)(205), 1.4972(54)(220). *Optical data:* In reflected light: gray, moderate anisotropism, weak bireflectance, nonpleochroic. *R<sub>o</sub>, R<sub>e</sub>:* (13.6, 12.2%) 460 nm, (12.9, 11.8%) 540 nm, (12.7, 11.7%) 580 nm, (12.1, 11.3%) 660 nm. In transmitted light, uniaxial (–), dichroic with O dark red and E orange-red; approximate indices of refraction calculated from reflectance data at 589 nm are *ω* 2.10, *ε'* 2.04. *Chemical analytical data:* Mean of thirty sets of electron-microprobe data: MgO 8.97, MnO 2.47, ZnO 14.24, Al<sub>2</sub>O<sub>3</sub> 0.82, Fe<sub>2</sub>O<sub>3</sub> 34.33, TiO<sub>2</sub> 0.01, Sb<sub>2</sub>O<sub>5</sub> 36.31, H<sub>2</sub>O 1.99, Total 99.14 wt.%. Empirical formula: (Zn<sub>1.58</sub>Mn<sub>0.31</sub>Mg<sub>0.06</sub>)<sub>Σ1.95</sub>Sb<sub>2.03</sub>(Mg<sub>1.95</sub>Fe<sub>3.88</sub>Al<sub>0.15</sub>)<sub>Σ5.98</sub>O<sub>14.01</sub>(OH)<sub>1.99</sub>. **Relationship to other species:** It is isostructural with nolanite, (V<sup>3+</sup>,Fe<sup>2+</sup>,Fe<sup>3+</sup>,Ti)<sub>10</sub>O<sub>14</sub>(OH)<sub>2</sub>.

**Name:** After Sven Rinman (1720–1792), mining scientist, metallurgist and chemist who was a member of the *Bergskollegium* (Board of Mines). He is considered by some the father of the Swedish mineral industry.

**Comments:** IMA No. 2000–036.

HOLISTAM, D., GATEDAL, K., SÖDERBERG, K. & NORRESTAM, R. (2001): Rinmanite, Zn<sub>2</sub>Sb<sub>2</sub>Mg<sub>2</sub>Fe<sub>4</sub>O<sub>14</sub>(OH)<sub>2</sub>, a new mineral species with a nolanite-type structure from the Garpenberg Norra mine, Dalarna, Sweden. *Canadian Mineralogist* 39, 1675–1683.

# Rouaite



MONOCLINIC

**Locality:** The old copper mines at Roua, Alpes Maritimes, France. It has been identified also from the Sterling Hill mine, Ogdensburg, New Jersey, U.S.A.

**Occurrence:** Found in cavities in cuprite. Associated minerals are: cuprite, copper, silver, algodonite, domeykite, malachite, connellite, olivenite, theoparacelsite and gerhardtite.

**General appearance:** As aggregates (up to 0.5 mm in diameter) of equidimensional to elongate crystals (up to 0.1 mm long).

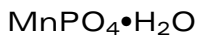
**Physical, chemical and crystallographic properties:** *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* dark emerald green. *Streak:* green. *Luminescence:* nonfluorescent. *Hardness:* could not be measured because of the small size. *Tenacity:* brittle. *Cleavage:* {001} perfect. *Fracture:* uneven. *Density:* 3.38 g/cm<sup>3</sup> (meas.), 3.38 g/cm<sup>3</sup> (calc.). **Crystallography:** Monoclinic,  $P2_1$ ,  $a$  5.596,  $b$  6.079,  $c$  6.925 Å,  $\beta$  94.67°,  $V$  234.8 Å<sup>3</sup>,  $Z = 2$ ,  $a:b:c = 0.9205:1:1.1392$ . *Morphology:* {001}, {100}, {110}, {1 $\bar{1}$ 0}, {0 $\bar{1}$ 1}. *Twinning:* rare on {001}. **X-ray powder-diffraction data:** 6.91(100)(001), 3.457(90)(111,002), 2.669(80)(120), 2.462(80)(121), 2.250(50)( $\bar{2}$ 02), 2.154(40)(013), 2.078(50)(122,103). **Optical data:** Biaxial (+),  $\alpha$  1.700,  $\beta$  1.715,  $\gamma$  1.738,  $2V(\text{meas.})$  81°,  $2V(\text{calc.})$  79°; dispersion  $r < v$ , strong; pleochroism  $X$  dark green blue,  $Y$  green blue,  $Z$  light green to colorless;  $X \wedge a = 5^\circ$  (in obtuse angle  $\beta$ ),  $Y = b$ ,  $Z \approx c$ . **Chemical analytical data:** Mean of five sets of electron-microprobe data (H<sub>2</sub>O by CHN): CuO 65.50, N<sub>2</sub>O<sub>5</sub> 21.64, H<sub>2</sub>O 11.90, Total 99.04 wt.%. Empirical formula: Cu<sub>1.99</sub>(NO<sub>3</sub>)<sub>0.97</sub>(OH)<sub>3.19</sub>. **Relationship to other species:** It has a dimorphic relationship with gerhardtite (orthorhombic).

**Name:** After the type locality.

**Comments:** IMA No. 1999-010.

SARP, H., ČERNÝ, R. & GUENEE, L. (2001): Rouaite, Cu<sub>2</sub>(NO<sub>3</sub>)(OH)<sub>3</sub>, un nouveau minéral: sa description et sa structure cristalline (Alpes-Maritimes, France). *Rivière Scientifique* 85, 3-12.

# Serrabrancaite



MONOCLINIC

**Locality:** The Alto Serra Branca pegmatite, approximately 10 km southwest of the village of Pedra Lavrada, Paraíba, Brazil.

**Occurrence:** Found in a granitic pegmatite intruded into biotite schist. Minerals in the pegmatite are: quartz, microcline, muscovite, albite, amblygonite, "apatite", beryl, uraninite, elbaite, members of the tantalite group, secondary uranium minerals, triphylite, trip-lite, purpurite, rockbridgeite, tavorite, barbosalite, huréaulite, eosphorite, phospho-siderite, carlhintzeite, colquirite, pachnolite, ralstonite and fluellite. Serrabrancaite is a product of alteration of triplite and is closely associated with vernadite.

**General appearance:** Equant or short prismatic crystals (up to 0.3 mm).

**Physical, chemical and crystallographic properties:** *Luster:* adamantine. *Diaphaneity:* translucent in thin fragments. *Color:* dark brown to dark greenish black. *Streak:* olive green. *Luminescence:* not mentioned. *Hardness:* 3½. *Tenacity:* brittle. *Cleavage:* none discernible. *Fracture:* uneven. *Density:* 3.17 g/cm<sup>3</sup> (meas.), 3.19 g/cm<sup>3</sup> (calc.). **Crystallography:** Monoclinic, C2/c, *a* 6.914, *b* 7.468, *c* 7.364 Å, β 112.29°, *V* 351.8 Å<sup>3</sup>, *Z* = 4, *a:b:c* = 0.9258:1:0.9861. *Morphology:* no forms were mentioned, but some are visible in the SEM images. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 4.856(12) (110), 4.633(15)( $\bar{1}$ 11), 3.503(100)(111), 3.271(10)(021), 2.957(10)( $\bar{2}$ 02), 2.516(19)(022), 2.104(12)(221). **Optical data:** Biaxial (sign not given), α 1.75, β 1.79, γ > 1.79, 2*V* not measured, pleochroism from dark brown to olive greenish brown. **Chemical analytical data:** Mean of four sets of electron-microprobe data: Mn<sub>2</sub>O<sub>3</sub> 46.85, P<sub>2</sub>O<sub>5</sub> 42.72, H<sub>2</sub>O 9.80, Total 99.37 wt.%. H<sub>2</sub>O by TGA. Empirical formula: Mn<sub>1.01</sub>P<sub>1.02</sub>O<sub>4.06</sub>•0.92H<sub>2</sub>O. **Relationship to other species:** Structurally related to synthetic MnPO<sub>4</sub>•H<sub>2</sub>O and MnAsO<sub>4</sub>•H<sub>2</sub>O and to members of the kieserite group.

**Name:** After the locality.

**Comments:** IMA No. 1998-006.

WITZKE, T., WEGNER, R., DOERING, T., PÖLLMANN, H. & SCHUCKMANN, W. (2000): Serrabrancaite, MnPO<sub>4</sub>•H<sub>2</sub>O, a new mineral from the Alto Serra Branca pegmatite, Pedra Lavrada, Paraíba, Brazil. *American Mineralogist* 85, 847-849.

LIGHTFOOT, P., CHEETHAM, A.K. & SLEIGHT, A.W. (1987): Structure of MnPO<sub>4</sub>•H<sub>2</sub>O by synchrotron X-ray powder diffraction. *Inorganic Chemistry* 26, 3544-3547.

## Sodic-ferripedrizite



MONOCLINIC

**Locality:** In the Arroyo de la Yedra, eastern Pedriza Massif, Sierra de Guadarrama, Central System, Spain. The locality is about 20 m east of the occurrence of sodic-ferri-clinoferroholmquistite (see abstract in *The Canadian Mineralogist*, Special Publication 4, 231).

**Occurrence:** In hydrothermal episyenites. Associated minerals are: albite, pyroxenes, Li-amphiboles and micas.

**General appearance:** Granular aggregates of subhedral crystals of mean size  $0.18 \times 0.10$  mm.

**Physical, chemical and crystallographic properties:** *Luster:* vitreous. *Diaphaneity:* semitranslucent.

*Color:* green. *Streak:* gray. *Luminescence:* nonfluorescent. *Hardness:* ~6. *Tenacity:* brittle. *Cleavage:* {110} perfect; parting {001} poor. *Fracture:* splintery. *Density:* 3.15 g/cm<sup>3</sup> (meas.), 3.15 g/cm<sup>3</sup> (calc.). *Crystallography:* Monoclinic, *C2/m*, *a* 9.536, *b* 17.789, *c* 5.277 Å,  $\beta$  102.53°, *V* 873.8 Å<sup>3</sup>, *Z* = 2, *a:b:c* = 0.5361:1:0.2966. *Morphology:* {010} and {001} are observed, and {100} is rare and poorly developed; prismatic and elongate on {001}. *Twinning:* none mentioned. *X-ray powder-diffraction data:* 8.246(24) (110), 4.446(22)(040), 3.397(28)(131), 3.056(100)(310), 2.749(54)(330), 2.699(60)(151), 1.920(20)(421), 1.639(44)(461), 1.396(23)(661). *Optical data:* Biaxial (-) (given as +),  $\alpha$  1.694,  $\beta$  1.698,  $\gamma$  1.702, *2V*(meas.) 83°, *2V*(calc.) 89.8° (given as 83°); dispersion *r* > *v*, medium; pleochroism strong, *X* green blue, *Y* blue green, *Z* yellow green, absorption *X* > *Y* > *Z*; *Y* = *b*, *X*  $\wedge$  *c* = 4°, *Z*  $\wedge$  *a* = 8° (both in obtuse angle  $\beta$ ). *Chemical analytical data:* Mean of twenty-four sets of electron-microprobe data: Li<sub>2</sub>O 3.98, Na<sub>2</sub>O 4.78, K<sub>2</sub>O 0.15, MgO 8.45, CaO 0.56, MnO 0.58, FeO 2.79, ZnO 0.12, Al<sub>2</sub>O<sub>3</sub> 1.26, Fe<sub>2</sub>O<sub>3</sub> 15.81, SiO<sub>2</sub> 57.70, TiO<sub>2</sub> 1.04, H<sub>2</sub>O (1.46), F 1.48, sum (100.16), less O = F 0.62, Total (99.54) wt.%. Li<sub>2</sub>O was determined by flame photometry, and H<sub>2</sub>O was calculated to give OH + F = 2. Empirical formula: (Na<sub>0.70</sub>K<sub>0.03</sub>) $\Sigma$ 0.73(Li<sub>1.34</sub>Na<sub>0.58</sub>Ca<sub>0.08</sub>) $\Sigma$ 2.00(Mg<sub>1.75</sub>Fe<sup>3+</sup><sub>1.65</sub>Li<sub>0.88</sub>Fe<sup>2+</sup><sub>0.32</sub>Al<sub>0.21</sub>Ti<sub>0.11</sub>Mn<sup>2+</sup><sub>0.07</sub>Zn<sub>0.01</sub>) $\Sigma$ 5.00 Si<sub>8.00</sub>O<sub>22.00</sub>[OH<sub>1.35</sub>F<sub>0.65</sub>] $\Sigma$ 2.00. **Relationship to other species:** It is a new member of the amphibole group.

**Name:** After the locality. Because of its chemical composition, it requires a new root name, pedrizite; the prefixes "sodic" and "ferri" are required by the amphibole classification.

**Comments:** IMA No. 1998-061.

OBERTI, R., CABALLERO, J.M., OTTOLINI, L., LÓPEZ-ANDRÉS, S. & HERREROS, V. (2000): Sodic-ferripedrizite, a new monoclinic amphibole bridging the magnesium – iron – manganese – lithium and the sodium–calcium groups. *American Mineralogist* 85, 576-585.



# Suredaite



ORTHORHOMBIC

**Locality:** The Oploca vein system of the Pirquita silver–tin deposit, in the Puna, 135 km west of Abra Pampa, Province of Jujuy, northwestern Argentina.

**Occurrence:** Found in a vein. Associated minerals are: franckeite, cylindrite, hocartite, rhodostannite and sphalerite. Minor amounts of Ag–Bi sulfosalts belonging to the andorite group, lillianite, as well as the pavonite homologous series.

**General appearance:** It has an overall similarity to teallite. Forms layers (up to 1 cm thick) composed of tabular prismatic crystals elongate along [010] and individual euhedral almost needle-like crystals.

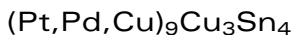
**Physical, chemical and crystallographic properties:** *Luster:* metallic. *Diaphaneity:* opaque. *Color:* grayish black. *Streak:* black. *Hardness:* VHN<sub>50</sub> 19.6 (range 18.2 to 20.6) kg/mm<sup>2</sup>, Mohs 2½ to 3. *Tenacity:* not given. *Cleavage:* {001}, {101} and {100} perfect. *Fracture:* not given. *Density:* 5.54 to 5.88 g/cm<sup>3</sup> (meas.), 5.66 g/cm<sup>3</sup> (calc.). **Crystallography:** Orthorhombic, *Pnma*, *a* 8.8221, *b* 3.7728, *c* 14.0076 Å, *V* 466.23 Å<sup>3</sup>, *Z* = 4, *a:b:c* = 2.3383:1:3.7128. *Morphology:* no forms were mentioned. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 5.483(26.4)(102), 4.128(100.0)(103), 3.730(30.0)(202), 3.1085(27.6)(112), 2.8081(50.8)(211), 2.7421(40.9)(204), 1.9335(53.5)(314), 1.6316(38.9)(124), 1.3754(26.5)(309). **Optical data:** In reflected light: white, anisotropic, metallic blue to mauve to brown, nonbireflectant, nonpleochroic. *R*<sub>1</sub> & *R*<sub>2</sub>: (34.3, 36.3%) 460 nm, (31.5, 33.1%) 540 nm, (30.3, 31.7%) 580 nm, (29.0, 30.2%) 640 nm. **Chemical analytical data:** Four sets of electron-microprobe data are given. The mean of 61 analyses of one of these sets are: Fe 0.77, As 1.41, Ag 0.80, Sn 30.12, Pb 42.27, S 24.23, Total 99.60 wt.%. Empirical formula: (Pb<sub>0.81</sub>As<sub>0.08</sub>Ag<sub>0.03</sub>Sn<sub>0.06</sub>)<sub>Σ0.98</sub>(Sn<sub>0.95</sub>Fe<sub>0.05</sub>)<sub>Σ1.00</sub>S<sub>3.01</sub>. **Relationship to other species:** It is the natural analogue of synthetic PbSnS<sub>3</sub>.

**Name:** After Ricardo Jose Sureda Leston (b. 1946), Professor and Head of the Department of Mineralogy and Economic Geology, University of Salta, Argentina, in recognition of his significant contributions to the mineralogy and metallogeny of northwestern Argentina.

**Comments:** IMA No. 1997–043.

PAAR, W.H., MILETICH, R., TOPA, D., CRIDDLE, A.J., DE BRODTKORB, M.K., AMTHAUER, G. & TIPPELT, G. (2000): Suredaite, PbSnS<sub>3</sub>, a new mineral species, from the Pirquitas Ag–Sn deposit, NW-Argentina: mineralogy and crystal structure. *American Mineralogist* **85**, 1066–1075.

# Tatyanaitite



ORTHORHOMBIC

**Locality:** The Oktyabr'sky deposit, Noril'sk complex, northern Siberia, Russia.

**Occurrence:** Found in massive sulfide ore. Associated minerals are: chalcopyrite, a chalcopyrite-like sulfide (e.g., mooihokite, talnakhite or putoranite), pentlandite, pyrrhotite, cubanite, galena, taimyrite, cabriite, stannopalladinite, atokite-rustenburgite, paolovite, froodite, sperrylite, maslovite, Ag-Au alloy, Fe-rich hydrous silicate, magnetite and calcite.

**General appearance:** Central zones of large elongate grains (up to ~1 cm) and as aggregates of smaller, irregular or platy grains.

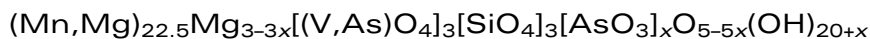
**Physical, chemical and crystallographic properties:** *Luster:* metallic. *Diaphaneity:* opaque. *Color:* megascopic color not given. *Streak:* not given. *Hardness:* VHN<sub>20</sub> 327 kg/mm<sup>2</sup>, Mohs 3½ to 4. *Tenacity:* rather ductile. *Cleavage:* none observed. *Fracture:* not given. *Density:* not measured, 13.55 g/cm<sup>3</sup> (calc.). **Crystallography:** Orthorhombic, *Pmmm*, *Pmm2* or *P222* (by analogy with synthetic material), *a* 7.89, *b* 4.07, *c* 7.73 Å, *V* 248 Å<sup>3</sup>, *Z* = 1, *a:b:c* = 1.9386:1:1.8993. *Morphology:* no forms were mentioned. *Twinning:* polysynthetic. **X-ray powder-diffraction data:** 2.283(10)(212), 2.163(4)(203), 2.030(2)(020), 1.369(3)(323), 1.218(2)(405,232), 1.143(2)(424). **Optical data:** In reflected light: pink with a lilac tinge, distinct to moderate anisotropism, weak to distinct birefractance, pleochroic from brownish pink to pinkish lilac. *R*<sub>1</sub> & *R*<sub>2</sub>: (42.8, 44.1%) 470 nm, (49.5, 50.0%) 546 nm, (51.8, 54.6%) 589 nm, (55.6, 56.8%) 650 nm. **Chemical analytical data:** Two sets of electron-microprobe data are given. The means of one set are: Pt 45.38, Pd 19.53, Cu 10.62, Fe 0.03, Ni 0.15, Sn 23.02, Sb 0.27, Pb n.d., Total 99.00 wt.%. Empirical formula: [(Pt<sub>4.76</sub>Pd<sub>3.75</sub>)<sub>Σ8.51</sub>Cu<sub>0.48</sub>]<sub>Σ8.99</sub>(Cu<sub>2.94</sub>Ni<sub>0.05</sub>Fe<sub>0.01</sub>)<sub>Σ3.00</sub>(Sn<sub>3.97</sub>Sb<sub>0.05</sub>)<sub>Σ4.02</sub>. **Relationship to other species:** The platinum-dominant analogue of taimyrite, Pd<sub>9</sub>Cu<sub>3</sub>Sn<sub>4</sub>.

**Name:** After Tatyan L. Evstigneeva (or Yevstigneeva) (b. 1945), of the Russian Academy of Sciences, who has studied the minerals of the Noril'sk deposit for many years.

**Comments:** IMA No. 1995-049a.

BARKOV, A.Y., MARTIN, R.F., POIRIER, G., TARKIAN, M., PAKHOMOVSKII, YA.A. & MEN'SHIKOV, YU.P. (2000): Tatyanaitite, a new platinum-group mineral, the Pt analogue of taimyrite, from the Noril'sk complex (northern Siberia, Russia). *European Journal of Mineralogy* 12, 391-396.

## Turtmannite



TRIGONAL

**Locality:** The Turtmann Valley, Valais, Switzerland.

**Occurrence:** In jacobsonite-rich Fe–Mn ores in Triassic marbles. Associated minerals are: jacobsonite, kutnohorite, barite, tephroite and spessartine.

**General appearance:** In micaceous flakes (up to 200  $\mu\text{m}$  long).

**Physical, chemical and crystallographic properties:** *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* bright yellow. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* could not be measured. *Tenacity:* very brittle. *Cleavage:* {001} perfect. *Fracture:* not given. *Density:* 3.60 to 4.0  $\text{g/cm}^3$  (meas.), 3.66  $\text{g/cm}^3$  (calc.). *Crystallography:* Trigonal,  $R\bar{3}c$ ,  $a$  8.259,  $c$  204.3  $\text{\AA}$ ,  $V$  12068  $\text{\AA}^3$ ,  $Z = 12$ ,  $c:a = 24.7367$ . *Morphology:* no forms were mentioned. *Twinning:* none mentioned. *X-ray powder-diffraction data:* 2.99(40) (0.1.62), 2.83(40)(2.2.44), 2.69(80)(3 $\bar{1}\bar{1}$ ), 2.43(60)(0.0.84), 2.38(80)(1.2.40), 1.561(100)(140). *Optical data:* Uniaxial (-),  $\omega$  1.787,  $\varepsilon$  could not be measured. *Chemical analytical data:* Mean of fourteen sets of electron-microprobe data: MgO 5.27, CaO 0.08, MnO 57.29, NiO 0.21, CoO 0.13, ZnO 0.06, BaO 0.05, Al<sub>2</sub>O<sub>3</sub> 0.69, SiO<sub>2</sub> 8.61, V<sub>2</sub>O<sub>5</sub> 8.09, As<sub>2</sub>O<sub>5</sub> 7.47, H<sub>2</sub>O (8.06), Total 96.01 wt.%. This is a complex mineral, and the derivation of an empirical formula is impossible without more information on the subtleties of the structure. *Relationship to other species:* It is probably related to mcgovernite.

**Name:** After the locality.

**Comments:** IMA No. 2000–007.

BRUGGER, J., ARMBRUSTER, T., MEISSER, N., HEJNEY, C. & GROBETY, B. (2001): Description and crystal structure of turtmannite, a new mineral with a 68  $\text{\AA}$  period related to mcgovernite. *American Mineralogist* **86**, 1494–1505.

# Verbeekite



MONOCLINIC

**Locality:** The dumps of the Musonoi Cu–Co–Mn–U mine, western portion of Shaba (formerly Katanga) Province, near Kolwezi, Democratic Republic of Congo (formerly Zaire); approximately at Lat. 10° 44' S and Long. 25° 26' E. Also at Hope's Nose, Torquay, Devon, England, U.K. (Lat. 58° 28' N, Long. 3° 28' W).

**Occurrence:** A primary phase formed from hydrothermal solutions at temperatures up to 120° C. The only directly associated mineral is oosterboschite. Other closely associated minerals are cuprian and palladian trogtalite, selenian digenite and selenian covellite. At Hope's Nose, verbeekite is associated with gold, chrisstanleyite, oosterboschite (?), unnamed Pd<sub>2</sub>HgSe<sub>4</sub> and cerussite.

**General appearance:** A single anhedral grain 200 × 200 μm at Musonoi; at Hope's Nose, a single anhedral grain 25 μm.

**Physical, chemical and crystallographic properties:** *Luster:* metallic. *Diaphaneity:* opaque. *Color:* black. *Streak:* black. *Hardness:* VHN<sub>5</sub> 550 kg/mm<sup>2</sup>, Mohs ~5½. *Tenacity:* brittle. *Cleavage:* none observed. *Fracture:* uneven. *Density:* could not be measured, 7.20 g/cm<sup>3</sup> (calc.). **Crystallography:** Monoclinic, C2/m, C2 or Cm, *a* 6.659, *b* 4.124, *c* 4.438 Å, β 92.76°, *V* 121.7 Å<sup>3</sup>, *Z* = 2, *a:b:c* = 1.6147:1:1.0761. *Morphology:* no forms were observed. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 4.423(30)(001), 3.496(30)(110), 2.718(100)(111), 1.955(50)(310), 1.896(50)( $\bar{1}$ 12). **Optical data:** In reflected light: nondescript gray, moderate anisotropism, nonbireflectant, non-pleochroic. R<sub>1</sub>, R<sub>2</sub>; <sup>imm</sup>R<sub>1</sub>, <sup>imm</sup>R<sub>2</sub>: (50.80, 52.30; 37.00, 38.40%) 470 nm, (51.85, 52.90; 37.75, 38.30%) 546 nm, (52.20, 53.55; 38.50, 38.60%) 589 nm, (52.40, 54.00; 38.80, 39.60%) 650 nm. **Chemical analytical data:** Mean of four sets of electron-microprobe data: Cu 0.5, Pd 39.6, Se 58.8, Total 98.9 wt.%. Empirical formula: (Pd<sub>0.99</sub>Cu<sub>0.02</sub>)<sub>Σ1.01</sub>Se<sub>1.99</sub>. **Relationship to other species:** It chemically is the Pd-analogue of sudovikovite (hexagonal PtSe<sub>2</sub>).

**Name:** After Théodore Verbeek (1927–1991), who was the first geoscientist to study the Musonoi palladium mineralization and who codiscovered the mineral with amateur mineralogist Ing. R. Coussement.

**Comments:** IMA No. 2001–005.

ROBERTS, A.C., PAAR, W.H., COOPER, M.A., TOPA, D., CRIDDLE, A.J. & JEDWAB, J. (2002): Verbeekite, monoclinic PdSe<sub>2</sub>, a new mineral from the Musonoi Cu–Co–Mn–U mine, near Kolwezi, Shaba Province, Democratic Republic of Congo. *Mineralogical Magazine* 66, 173–179.