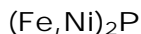


NEW MINERALS

JOSEPH A. MANDARINO[§]

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

Allabogdanite



ORTHORHOMBIC

Locality: The Onello iron meteorite found in 1997 in the alluvium of the Bol'shoi Dolguchan River, Onello River basin, Aldan Shield, Sakha-Yakutia, Russia (Lat. 62° 20'N, Long. 137° 40'E).

Occurrence: In "plessite", an intergrowth of taenite and kamacite; other associated minerals are: nickelporphide, schreibersite, awaruite and graphite.

General appearance: Lath-like crystals (up to $0.4 \times 0.1 \times 0.01$ mm).

Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* light straw-yellow. *Streak:* not given. *Hardness:* 5 to 6. *Tenacity:* highly brittle. *Cleavage:* not observed. *Fracture:* not given. *Density:* could not be measured, 7.11 g/cm^3 (calc.). **Crystallography:** Orthorhombic, *Pnma*, *a* 5.748, *b* 3.548, *c* 6.661 Å, *V* 135.8 Å³, *Z* = 4, *a:b:c* = 1.6201:1:1.8774. Morphology: {001} and probably {110} and {100}; flattened on {001}. Twinning: gypsum-like possibly with twin plane {110}. **X-ray powder-diffraction data:** 2.238(100)(112,210), 2.120(80)(211), 2.073(70)(103), 1.884(50)(013,212), 1.843(40)(301), 1.788(40)(113), 1.774(40)(020), 1.758(40)(203), 1.346(40)(123,313,410), 1.277(40)(321). **Optical data:** In reflected light: creamy, distinct anisotropism from light to dark creamy, no bireflectance, pleochroism not given. *R*₁, *R*₂: (47.0, 37.6%) 480 nm, (48.2, 39.2%) 540 nm, (49.6, 40.7%) 580 nm, (52.3, 44.3%) 660 nm. **Chemical analytical data:** Mean of nine sets of electron-microprobe data: Ni 20.7, Fe 57.7, Co 1.4, P 20.4, Total 100.2 wt.%. Empirical formula: $(\text{Fe}_{1.50}\text{Ni}_{0.51}\text{Co}_{0.03})_{\Sigma 2.04}\text{P}_{0.96}$. **Relationship to other species:** It has a polymorphic relationship with barringerite, which is hexagonal.

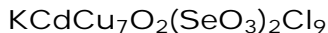
Name: After Alla N. Bogdanova (b. 1947), crystallographer at the Geological Institute, Kola Science Center of the Russian Academy of Sciences, Apatity, Kola Peninsula, Russia.

Comments: IMA No. 2000-038.

BRITVIN, S.N., RUDASHEVSKY, N.S., KRIVOVICHEV, S.V., BURNS, P.C. & POLEKHOVSKY, YU.S. (2002): Allabogdanite, $(\text{Fe, Ni})_2\text{P}$, a new mineral from the Onello meteorite: the occurrence and crystal structure. *American Mineralogist* **87**, 1245-1249.

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Burnsite



 HEXAGONAL

Locality: The Great Fissure Tolbachik eruption (GFTE), Kamchatka Peninsula, Russia.

Occurrence: In a fumarole. Associated minerals are: cotunnite, sophiite, ilinskite, georgbokite, chloromenite and an undefined Cu–Pb selenite.

General appearance: Usually as round anhedral equidimensional grains (up to 0.1 mm) with no obvious crystal forms.

Physical, chemical and crystallographic properties: *Luster:* given as “strongly vitreous (metalloid)” but the optical data indicate adamantine. *Diaphaneity:* opaque to translucent. *Color:* dark red. *Streak:* red. *Luminescence:* nonfluorescent. *Hardness:* VHN 12 kg/mm², Mohs 1 to 1½. *Tenacity:* brittle. *Cleavage:* {001} good. *Fracture:* uneven. *Density:* could not be measured, 3.85 g/cm³ (calc.). **Crystallography:** Hexagonal, *P*6₃/*mmc*, *a* 8.7805, *c* 15.521 Å, *V* 1036.3 Å³, *Z* = 2, *c/a* = 1.7677. Morphology: no forms were observed. Twinning: none mentioned. **X-ray powder-diffraction data:** 7.779(100)(002), 6.823(50)(101), 4.391(80)(110), 3.814(80)(200), 3.066(70)(203), 2.582(50)(006), 2.501(60)(213), 2.190(50)(220). **Optical data:** Uniaxial (–), *ω* 1.920, *ε* 1.912, nonpleochroic. **Chemical analytical data:** Mean of an unstated set of electron-microprobe data: K₂O 4.3, CuO 46.74, CdO 10.45, SeO₂ 19.91, Cl 25.46, sum 106.86, less O = Cl 5.75, Total 101.11 wt.%. Empirical formula: K_{1.08}Cd_{0.97}Cu_{6.98}O_{2.08}(SeO₃)_{2.13}Cl_{8.53}. **Relationship to other species:** The only chemically related species are georgbokiite, Cu₅O₂(SeO₃)₂Cl₂, chloromenite, Cu₉O₂(SeO₃)₄Cl₆, and ilinskite, NaCu₅O₂(SeO₃)₂Cl₃.

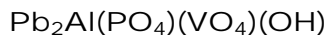
Name: After Peter C. Burns (b. 1966), Professor of Crystallography at the University of Notre Dame, Notre Dame, Indiana, USA, in recognition of his contributions to structural mineralogy, in particular of Cu²⁺ oxysalt minerals.

Comments: IMA No. 2000–050.

KRIVOVICHEV, S.V., VERGASOVA, L.P., STAROVA, G.L., FILATOV, S.K., BRITVIN, S.N., ROBERTS, A.C. & STEELE, I.M. (2002): Burnsite, KCdCu₇O₂(SeO₃)₂Cl₉, a new mineral species from the Tolbachik Volcano, Kamchatka Peninsula, Russia. *Canadian Mineralogist* **40**, 1171–1175.

BURNS, P.C., KRIVOVICHEV, S.V. & FILATOV, S.K. (2002): New Cu²⁺ coordination polyhedra in the crystal structure of burnsite, KCdCu₇O₂(SeO₃)₂Cl₉. *Canadian Mineralogist* **40**, 1587–1595.

Bushmakinite



MONOCLINIC

Locality: The Berezovskoye gold deposit, middle Urals, Russia.

Occurrence: In the oxidized zone in a "nest" consisting of galena, tetrahedrite and tennantite in a quartz vein. Other associated minerals are: cerussite, bindheimite, vauquelinite, mottramite and pyromorphite.

General appearance: Lamellar crystals (up to $0.3 \times 0.2 \times 0.02$ mm).

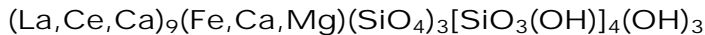
Physical, chemical and crystallographic properties: *Luster:* given as vitreous but the optical data indicate adamantine. *Diaphaneity:* translucent. *Color:* bright yellow. *Streak:* yellowish. *Luminescence:* nonfluorescent. *Hardness:* 3 to 3½. *Tenacity:* brittle. *Cleavage:* {001} perfect. *Fracture:* stepped to uneven. *Density:* not measured, 6.22 g/cm³ (calc.). **Crystallography:** Monoclinic, $P2_1/m$, a 7.734, b 5.814, c 8.69 Å, β 112.1°, V 362 Å³, $Z = 2$, $a:b:c = 1.3302:1:1.4947$. Morphology: probably {001}. Twinning: none observed. **X-ray powder-diffraction data:** 4.68(8)(011), 3.57(5)(111), 3.21(10)(211), 2.91(8)(212, 103), 2.71(7)(021,112), 2.27(4)(220), 2.05(5)(123,114). **Optical data:** Biaxial (-), α 1.99, β 2.03, γ 2.06, $2V(\text{meas.})$ large, $2V(\text{calc.})$ 80°; dispersion $r < v$, significant; nonpleochroic; orientation is given as X (or Y) $\wedge a = -11^\circ$, $Z = c$, but this is not possible in the monoclinic system. **Chemical analytical data:** Mean of four sets of electron-microprobe data (H_2O calculated from the ideal formula): CuO 2.46, ZnO 0.08, PbO 65.95, Al₂O₃ 5.75, Fe₂O₃ 0.05, P₂O₅ 11.67, V₂O₅ 9.84, As₂O₅ 0.06, SO₃ 0.10, CrO₃ 1.99, H₂O (1.35), Total (99.30) wt.%. Empirical formula: $\text{Pb}_{2.02}(\text{Al}_{0.77}\text{Cu}_{0.21}\text{Zn}_{0.01})_{\Sigma 0.99}(\text{PO}_4)_{1.00}[(\text{VO}_4)_{0.74}(\text{CrO}_4)_{0.14}(\text{PO}_4)_{0.12}(\text{SO}_4)_{0.01}]_{\Sigma 1.01}(\text{OH})_{1.02}$. **Relationship to other species:** It is a member of the brackebuschite group, specifically the Pb-, Al-, PO₄-, VO₄-dominant member.

Name: After the Russian mineralogist A.F. Bushmakina (1947–1999), who made significant contributions to the mineralogy of the oxidized zone of the Berezovskoye deposit.

Comments: IMA No. 2001–031.

PEKOV, I.V., KLEIMENOV, D.A., CHUKANOV, N.V., YAKUBOVICH, O.V., MASSA, W., BELAKOVSKIY, D.I. & PAUTOV, L.A. (2002): Bushmakinite $\text{Pb}_2\text{Al}(\text{PO}_4)(\text{VO}_4)(\text{OH})$, a new mineral of the brackebuschite group from the oxidized zone of the Berezovskoye gold deposit, the middle Urals. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* **131**(2), 62–71 (in Russ.).

Cerite-(La)



TRIGONAL

Locality: Mt. Yukspor, Khibina massif, Kola Peninsula, Russia.

Occurrence: In an aegirine – natrolite – microcline vein in foyaite. Associated minerals are: aegirine, anatase, ancylite-(Ce), barylite, catapleiite, cerite-(Ce), chabazite-Ca, edingtonite, fluorapatite, galena, ilmenite, microcline, natrolite, sphalerite, strontianite and vanadinite.

General appearance: Porous pseudomorphs (up to 7 cm long) after an unidentified hexagonal prismatic mineral, possibly belovite-(Ce). Cerite-(La) occurs as framework-like aggregates of crystals up to 2 mm across within the pseudomorphs.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* translucent. *Color:* light yellow to pinkish brown. *Streak:* white. *Luminescence:* not mentioned. *Hardness:* 5. *Tenacity:* brittle. *Cleavage:* not observed. *Fracture:* conchoidal. *Density:* 4.7 g/cm³ (meas.), 4.75 g/cm³ (calc.). **Crystallography:** Trigonal, *R*3*c*, *a* 10.7493, *c* 38.318 Å, *V* 3834.4 Å³, *Z* = 6, *c/a* = 3.5647. Morphology: {102} and {001}, habit equant to tabular on {001}. Twinning: none mentioned. **X-ray powder-diffraction data:** 3.53(26)(1.0.10, 211), 3.47(40)(122), 3.31(38)(214), 3.10(25)(300), 2.958(100)(0.2.10), 2.833(37)(128), 2.790(24)(306), 2.689(34)(220), 1.949(34)(238, 1.3.13). **Optical data:** Uniaxial (+), ω 1.810, ε 1.820, nonpleochroic. **Chemical analytical data:** Mean of 42 to 70 sets of electron-microprobe data (with H₂O by the Penfield method) gave: MgO 0.51, CaO 5.09, SrO 1.97, Fe₂O₃ 1.40, La₂O₃ 37.57, Ce₂O₃ 23.67, Pr₂O₃ 0.61, Nd₂O₃ 1.48, Sm₂O₃ 0.10, Gd₂O₃ 0.24, SiO₂ 22.38, P₂O₅ 0.63, H₂O 3.20, Total 98.85 wt.%. Empirical formula: (La_{4.26}Ce_{2.67}Ca_{1.38}Sr_{0.35}Nd_{0.16}Pr_{0.07}Gd_{0.02}Sm_{0.01}) Σ 8.92(Fe_{0.32}Ca_{0.30}Mg_{0.23}) Σ 0.85(SiO₄)_{3.00}[(Si_{0.84}P_{0.16}) Σ 1.00O_{3.11}(OH)]₄(OH)_{2.56}. **Relationship to other species:** It is the La-dominant analogue of cerite-(Ce).

Name: Reflects its composition as the La-dominant analogue of cerite-(Ce).

Comments: IMA No. 2001–042.

PAKHOMOVSKY, YA.A., MEN'SHIKOV, YU.P., YAKOVENCHUK, V.N., IVANYUK, G.YU., KRIVOVICHEV, S.V. & BURNS, P.C. (2002): Cerite-(La), (La,Ce,Ca)₉(Fe,Ca,Mg)(SiO₄)₃[SiO₃(OH)]₄(OH)₃, a new mineral species from the Khibina alkaline massif: occurrence and crystal structure. *Canadian Mineralogist* **40**, 1177-1184.

Ciprianiite



MONOCLINIC

Locality: Tre Croce, near Vetralla, Viterbo province, Latium, Italy.

Occurrence: In miarolitic cavities in a syenitic ejectum within a pyroclastic formation. Associated minerals are: danburite, thorite, fluorite, tourmaline and a cancrinite-group mineral.

General appearance: Small (<0.5 mm) tabular crystals.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* translucent to transparent. *Color:* brown to pale brown. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* not given. *Tenacity:* brittle. *Cleavage:* {100} fair to good. *Fracture:* conchoidal. *Density:* could not be measured, 3.97 g/cm³ (calc.). **Crystallography:** Monoclinic, *P2/a*, *a* 19.059, *b* 4.729, *c* 10.291 Å, β 111.33°, *V* 864.0 Å³, *Z* = 2, *a:b:c* = 4.0302:1:2.1761. *Morphology:* {010}, tabular. *Twinning:* frequent on (100). **X-ray powder-diffraction data:** 4.729(72)(010), 3.454(79)(212), 3.089(86)(412), 2.911(74)(212), 2.846(100)(411), 2.653(80)(413), 2.648(79)(013), 2.634(84)(411). **Optical data:** could not be determined. **Chemical analytical data:** Mean of two to four sets of electron-microprobe data (light elements by SIMS): Li₂O 0.05, BeO 1.95, MgO 0.18, CaO 24.60, BaO 0.00, B₂O₃ 13.28, Al₂O₃ 2.33, Cr₂O₃ 0.02, Mn₂O₃ 0.37, Fe₂O₃ 2.87, Y₂O₃ 0.19, La₂O₃ 1.39, Ce₂O₃ 5.48, Pr₂O₃ 0.86, Nd₂O₃ 3.03, Sm₂O₃ 0.33, Eu₂O₃ 0.05, Gd₂O₃ 0.14, Dy₂O₃ 0.05, Er₂O₃ 0.01, Yb₂O₃ 0.01, SiO₂ 22.94, TiO₂ 0.73, ThO₂ 15.80, UO₂ 0.87, H₂O 0.47, F 0.89, sum 98.89, less O = F 0.37, Total 98.52 wt.%. Empirical formula: Ca_{4.00}[(REE)_{0.73}Th_{0.63}Ca_{0.60}U_{0.03}]_{Σ1.99}(Al_{0.48}Fe³⁺_{0.38}Ti_{0.10}Mg_{0.05})_{Σ1.01}(Be_{0.82}□_{0.14}Li_{0.04})_{Σ1.00}B_{4.00}Si_{4.01}O_{22.00}[O_{0.97}(OH)_{0.54}F_{0.49}]_{Σ2.00}. **Relationship to other species:** It is a member of the hellandite group.

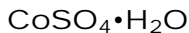
Name: After Curzio Cipriani (b. 1927), Professor of Mineralogy and Head of the Museum of Mineralogy, later of Natural History, at the Università di Firenze, Italy.

Comments: IMA No. 2000-021.

DELLA VENTURA, G., BONAZZI, P., OBERTI, R. & OTTOLONI, L. (2002): Ciprianiite and mottanaite-(Ce), two new minerals of the hellandite group from Latium (Italy). *American Mineralogist* **87**, 739-744.

OBERTI, R., DELLA VENTURA, G., OTTOLONI, L., HAWTHORNE, F.C. & BONAZZI, P. (2002): Re-definition, nomenclature and crystal-chemistry of the hellandite group. *American Mineralogist* **87**, 745-752.

Cobaltkieserite



MONOCLINIC

Locality: Bastnäs, Skinnskatteberg, Sweden (Lat. 59° 51'N, Long. 15° 35'E).

Occurrence: In a dark, dense quartzitic rock. Associated minerals are: cobaltite, pyrite, chalcopyrite, quartz, garnet, scorodite and erythrite.

General appearance: Euhedral crystals (0.5 to 3 μm).

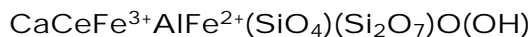
Physical, chemical and crystallographic properties: *Luster:* powdery. *Diaphaneity:* not given. *Color:* pink. *Streak:* not given. *Luminescence:* not mentioned. *Hardness:* 2 to 3. *Tenacity:* not given. *Cleavage:* not given. *Fracture:* not given. *Density:* could not be measured, 3.28 g/cm³ (calc.). **Crystallography:** Monoclinic, *C2/c* (by analogy with synthetic material), *a* 6.980, *b* 7.588, *c* 7.639 Å, β 118.65°, *V* 355.06 Å³, *Z* = 4, *a:b:c* = 0.9199:1:1.0067. *Morphology:* no forms were identified, but the crystals are largely euhedral with a thick tabular to "bipyramidal" habit. *Twinning:* none mentioned. **X-ray powder-diffraction data:** 4.829(33)($\bar{1}11$), 3.405(100)(11 $\bar{2}$), 3.339(34)(111), 3.291(32)(021), 3.062(56)(200), 2.567(30)(2 $\bar{2}1$), 2.513(49)(02 $\bar{2}$). **Optical data:** Biaxial (+), no other data could be determined because of the minuteness of the crystals. **Chemical analytical data:** Mean of twenty sets of electron-microprobe data (H₂O calculated): CoO 42.7, FeO 0.2, SiO₂ 0.3, As₂O₅ 4.3, SO₃ 44.2, H₂O (10.5), Total (102.2) wt.%. Empirical formula: Co_{0.98}(S_{0.95}As_{0.06}Si_{0.01}) Σ 1.02O_{4.00}•1.00H₂O. **Relationship to other species:** It is the cobalt-dominant analogue of kieserite, MgSO₄•H₂O.

Name: Reflects the relationship to kieserite.

Comments: IMA No. 2002-004. Slowly soluble in water.

HOLTSTAM, D. (2002): Cobaltkieserite, CoSO₄•H₂O, a new mineral species from Bastnäs, Skinnskatteberg, Sweden. *Geologiska Föreningens i Stockholm Förhandlingar* **124**, 117-119.

Ferriallanite-(Ce)



MONOCLINIC

Locality: Mount Ulyn Khuren, Altai Range, Mongolian People's Republic (approximately at Lat. 48° 32'N, Long. 92° 55'E).

Occurrence: In an alkaline granitic pegmatite. Associated minerals are: zircon, quartz, kinosite-(Y), aegirine, β -fergusonite-(Y), yttrian ilvaite, ilvaite, hingganite-(Ce), neodymian allanite-(Ce), magnetite, fayalite and fluorite.

General appearance: An aggregate of subhedral grains 0.3×0.5 to 1×2 mm.

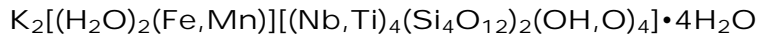
Physical, chemical and crystallographic properties: *Luster:* resinous. *Diaphaneity:* opaque to translucent. *Color:* black with red or orange internal reflections. *Streak:* brown. *Luminescence:* nonfluorescent. *Hardness:* VHN_{100} 1250 kg/mm^2 , Mohs 6. *Tenacity:* brittle. *Cleavage:* not observed. *Fracture:* conchoidal to uneven. *Density:* 4.22 g/cm^3 (meas.), 4.16 g/cm^3 (calc.) for the crystal used for the structure refinement and 4.21 g/cm^3 (calc.) for another sample. **Crystallography:** Monoclinic, $P2_1/m$, a 8.962, b 5.836, c 10.182 Å, β 115.02°, V 482.6 Å³, $Z = 2$, $a:b:c = 1.5356:1:1.7447$. Morphology: no forms were observed. Twinning: none mentioned. **X-ray powder-diffraction data:** 3.55(55)($\bar{2}11$), 2.93(65)($\bar{1}13$), 2.72(80)(120,013), 2.69(55)(300), 2.63(60)($\bar{3}11$), 2.34(55)($\bar{2}22$), 2.18(100)(122, $\bar{1}23$, $\bar{4}01$), 2.14(80)(221, $\bar{4}03$, $\bar{2}23$,014), 1.46(50)(040). **Optical data:** Biaxial (-), α 1.825, β 1.855, γ 1.880, $2V$ could not be measured, $2V(\text{calc.})$ 83°; dispersion $r < v$, strong; pleochroism X greenish gray, Y brown, Z dark red-brown, $Z > Y > X$; orientation not given. **Chemical analytical data:** Mean of four sets of electron-microprobe data: CaO 10.85, MnO 0.82, FeO 8.44, Al₂O₃ 6.07, Fe₂O₃ 18.88, La₂O₃ 5.12, Ce₂O₃ 10.86, Pr₂O₃ 1.63, Nd₂O₃ 5.29, SiO₂ 28.72, TiO₂ 1.85, H₂O 1.48, Total 100.01 wt.%. Empirical formula given by the authors (with all REE indicated as Ce) is: $(\text{Ca}_{0.97}\text{Ce}_{0.03})_{\Sigma 1.00}(\text{Ce}_{0.89}\text{Ca}_{0.11})_{\Sigma 1.00}(\text{Fe}^{3+}_{0.80}\text{Ti}_{0.14}\text{Al}_{0.06})_{\Sigma 1.00}(\text{Al}_{0.56}\text{Fe}^{3+}_{0.44})_{\Sigma 1.00}(\text{Fe}^{2+}_{0.93}\text{Mn}_{0.07})_{\Sigma 1}(\text{Si}_{0.94}\text{Al}_{0.06})\text{O}_{4.00}(\text{Si}_2\text{O}_7)\text{O}(\text{OH})$. **Relationship to other species:** It is the Fe³⁺-dominant analogue of allanite-(Ce).

Name: Reflects the relationship to allanite-(Ce).

Comments: IMA No. 2000-041.

KARTASHOV, P., FERRARIS, G., IVALDI, G., SOKOLOVA, E. & MCCAMMON, C.A. (2002): Ferriallanite-(Ce), $\text{CaCeFe}^{3+}\text{AlFe}^{2+}(\text{SiO}_4)(\text{Si}_2\text{O}_7)\text{O}(\text{OH})$, a new member of the epidote group: description, X-ray and Mössbauer study. *Canadian Mineralogist* **40**, 1641-1648.

Gjerdingenite-Fe



MONOCLINIC

Locality: Gjerdingsselve, Lunner, Oppland, Norway.

Occurrence: In miarolitic cavities in ekerite, a sodic granite. Associated minerals are: quartz, orthoclase, albite, aegirine, kupletskite, elpidite, lorenzenite, pyrochlore, monazite-(Ce), gagarinite-(Y), ralstonite, gearksutite and molybdenite.

General appearance: Prismatic to lath-shaped crystals up to 1 mm long and subparallel or irregular aggregates to 3 mm.

Physical, chemical and crystallographic properties: *Luster:* vitreous to waxy. *Diaphaneity:* translucent to rarely transparent. *Color:* pale yellow to orange yellow to brownish yellow. *Streak:* white to faint yellow. *Luminescence:* nonfluorescent. *Hardness:* about 5. *Tenacity:* very brittle. *Cleavage:* none observed. *Fracture:* uneven. *Density:* 2.82 g/cm³ (meas.), 2.83 g/cm³ (calc.). **Crystallography:** Monoclinic, *C2/m*, *a* 14.529, *b* 13.943, *c* 7.837 Å, β 117.61°, *V* 1406.8 Å³, *Z* = 2, *a:b:c* = 1.0420:1:0.5621. Morphology: {100}, {010}, {001}, {201}, {021}; flattened on {001} and elongate along [010]; {010} is subordinate or may be lacking. Twinning: present and was used to solve the crystal structure. **X-ray powder-diffraction data:** 6.92(80)(020,001), 6.42(50)(200,201), 4.94(70)(021), 3.225(100)(421,400,402), 3.114(67)(041,022), 2.512(50)(441,401,403). **Optical data:** Biaxial (+), α 1.6676, β 1.7001, γ 1.794, 2*V*(meas.) 58.5°, 2*V*(calc.) 63.7°; dispersion not observed; nonpleochroic; *Y* = *b*. **Chemical analytical data:** Thirty-nine analyses were carried out by electron microprobe. One such set of data is given here: Na₂O 0.68, K₂O 6.76, CaO 0.08, MnO 2.97, FeO 3.44, Al₂O₃ 0.20, SiO₂ 36.35, TiO₂ 10.14, ZrO₂ 0.71, Nb₂O₅ 23.24, H₂O not determined, Total 84.57 wt.%. Crystal-chemical formula (with Si + Al = 16) derived from the structure determination: { [K_{1.20}Na_{0.72}(H₂O)_{2.08}]_{Σ4.00} [K_{2.08}(H₂O)_{1.92}]_{Σ4.00} } [(H₂O)_{3.40}K_{0.56}Ca_{0.04}]_{Σ4.00} (Fe_{0.95}Mn_{0.75}□_{0.30})_{Σ2.00} (Nb_{4.30}Ti_{3.45}Fe_{0.20}Zr_{0.05})_{Σ8.00} (Si_{15.90}Al_{0.10})_{Σ16.00} O_{48.00} [(OH)_{4.16}O_{3.84}]_{Σ8.00} • 4.00H₂O. **Relationship to other species:** It is a member of the labuntsovite group.

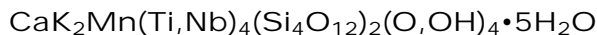
Name: Assigned according to the IMA-approved nomenclature for the labuntsovite group. In terms of root names, gjerdingenite is an analogue of kuzmenkoite and has Nb > Ti at the *M* site, whereas kuzmenkoite has Ti > Nb. The dominant cation in the *D* site is Fe for gjerdingenite, so the name is gjerdingenite-Fe.

Comments: IMA No. 2001-009.

RAADE, G., FERRARIS, G., GULA, A. & IVALDA, G. (2002): Gjerdingenite-Fe from Norway, a new mineral species in the labuntsovite group: description, crystal structure and twinning. *Canadian Mineralogist* **40**, 1629-1639.

CHUKANOV, N.V., PEKOV, I.V. & KHOMYAKOV, A.P. (2002): Recommended nomenclature for labuntsovite-group minerals. *European Journal of Mineralogy* **14**, 165-173.

Gutkovaite-Mn



MONOCLINIC

Locality: Maly Mannepakhk, Khibina alkaline massif, Kola Peninsula, Russia.

Occurrence: In a pegmatite in nepheline syenite. Associated minerals are: microcline, aegirine, arfvedsonite, nepheline, eudialyte, albite, lorenzenite, loparite, aenigmatite, manganneptunite, murmanite, analcime, natrolite, stilbite, chabazite, kuzmenkoite-Mn, nontronite, among others.

General appearance: Coarse prismatic crystals up to 0.8 mm long.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* translucent to transparent. *Color:* pale yellowish pink. *Streak:* white. *Luminescence:* not mentioned. *Hardness:* 5. *Tenacity:* brittle. *Cleavage:* not observed. *Fracture:* uneven. *Density:* 2.83 g/cm³ (meas.), 2.80 g/cm³ (calc.). **Crystallography:** Monoclinic, *Cm*, *a* 14.30, *b* 13.889, *c* 7.760 Å, β 117.51°, *V* 1367 Å³, *Z* = 2, *a:b:c* = 1.0296:1:0.5587. *Morphology:* no forms were mentioned. *Twinning:* microtwinning on (001) and (401). **X-ray powder-diffraction data:** 7.0(7)(020,001), 6.33(5)(20 $\bar{1}$,200), 4.90(4)(021), 3.22(9)(42 $\bar{1}$,40 $\bar{2}$,400), 3.05(10)(022,24 $\bar{1}$,240), 2.57(5)(24 $\bar{2}$,241), 2.48(6)(44 $\bar{1}$,40 $\bar{3}$,401). **Optical data:** Biaxial (+), α 1.688, β 1.700, γ 1.805, 2*V*(meas.) 35°, 2*V*(calc.) 39°; dispersion not observed; nonpleochroic; orientation not given. **Chemical analytical data:** Mean of six sets of electron-microprobe data: Na₂O 0.18, K₂O 6.54, MgO 0.17, CaO 4.81, MnO 4.96, FeO 0.61, ZnO 0.13, SrO 0.54, BaO 1.03, Al₂O₃ 0.17, SiO₂ 41.03, TiO₂ 24.47, ZrO₂ 0.08, Nb₂O₅ 5.14, H₂O 8.67, Total 98.53 wt.%. Empirical formula: (Ca_{1.00}Na_{0.07})Σ1.07(K_{1.63}Ba_{0.08}Sr_{1.06})Σ1.77(Mn_{0.82}Fe_{0.10}Mg_{0.05}Zn_{0.02})Σ0.99(Ti_{3.59}Nb_{0.45}Zr_{0.01})Σ4.05[(Si_{4.00}Al_{0.02})Σ4.02O_{12.07}]_{2.00}[O_{2.47}(OH)_{1.53}]_{Σ4.00}•4.87H₂O. **Relationship to other species:** It is a member of the labuntsovite group with Mn dominant at the *D* site. The *A* site in this species is divided into two sites: the A(I) site is occupied by Ca, and the A(II) site is vacant; this results in lowering the symmetry from *C2/m* to *Cm*.

Name: After N.N. Gutkova (1896–1960?), who intensively studied the Khibina–Lovozero alkaline complex; the suffix denotes the dominance of Mn at the *D* site.

Comments: IMA No. 2001–038.

PEKOV, I.V., CHUKANOV, N.V., RASTSVETAeva, R.K., ZADOV, A.E. & KONONKOVA, N.N. (2002): Gutkovaite-Mn CaK₂Mn(Ti,Nb)₄(Si₄O₁₂)₂(O,OH)₄•5H₂O, a new mineral of the labuntsovite group from the Khibina massif, Kola Peninsula. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* **131**(2), 51-57 (in Russ.).

RASTSVETAeva, R.K., PEKOV, I.V. & NEKRASOV, YU.V. (2001): Crystal structure and microtwinning of Ca-rich analog of labuntsovite. *Kristallografiya* **46**, 415-417 (in Russ.).

CHUKANOV, N.V., PEKOV, I.V. & KHOMYAKOV, A.P. (2002): Recommended nomenclature for labuntsovite-group minerals. *European Journal of Mineralogy* **14**, 165-173.

Hoganite



MONOCLINIC

Locality: The Potosi silver – lead – zinc deposit, 2 km northeast of Broken Hill, New South Wales, Australia (Lat. 31° 56'S, Long. 141° 30'E).

Occurrence: In gossan near a mass of decomposing leaves. Associated minerals are: goethite, hematite, quartz, linarite, malachite, azurite, cuprian smithsonite, cerussite and paceite.

General appearance: Isolated prisms (up to 0.6 mm long).

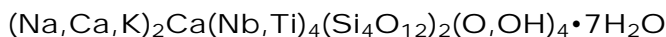
Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* dark bluish green. *Streak:* pale blue. *Luminescence:* nonfluorescent. *Hardness:* 1½. *Tenacity:* brittle. *Cleavage:* could not be observed, but {001} perfect and {110} distinct are reported on synthetic material. *Fracture:* conchoidal. *Density:* 1.93 g/cm³ (calc.). **Crystallography:** Monoclinic, *C*2/*c*, *a* 13.162, *b* 8.555, *c* 13.850 Å, β 117.08°, *V* 1388.6 Å³, *Z* = 8, *a*:*b*:*c* = 1.5385:1:1.6189. *Morphology:* forms observed are similar to those reported for synthetic crystals {101̄}, {011̄}, {211̄}, {110} and {112̄}; also reported are synthetic {110} tablets with {001}, {100} and {201}. *Twinning:* none observed, but butterfly twins have been reported for synthetic crystals. **X-ray powder-diffraction data:** 6.921(100)(110), 6.176(14)(002), 5.872(9)(200), 5.382(10)(11), 3.592(11)(221̄), 3.532(28)(202), 2.291(9)(333), 2.278(10)(402). The data in the paper are indexed on the alternate setting in space group *A*2/*a* to compare with the data in PDF 27–145, but have been changed here for the given cell in space group *C*2/*c*. **Optical data:** Biaxial (+), α 1.533, β 1.541, γ 1.554, 2*V*(meas.) 85°, 2*V*(calc.) 77°; dispersion *r* < *v*, medium; pleochroism strong *X* blue, *Y* pale bluish, *Z* pale bluish green, *X* > *Y* > *Z*; orientation unknown. See Comments. **Chemical analytical data:** Wet-chemical analysis by AAS (Ca, Cu, Mg, Zn, Pb and Fe), CHN analyzer (C and H) and O by difference gave: C 23.85, H 3.95, Cu 31.6, Fe 0.4, O (40.2), Total (100.00) wt.%. Empirical formula: C_{4.01}H_{7.90}O_{5.07}Cu_{1.00}Fe_{0.01} or Cu_{1.00}(CH₃COO)_{2.00}•0.95H₂O. **Relationship to other species:** It is an acetate.

Name: After Graham P. Hogan (b. 1957), of Broken Hill, New South Wales, Australia, a miner and well-known collector of Broken Hill minerals, who originally recovered the material.

Comments: IMA No. 2001–029. Owing to the very small amount of natural material, the optical properties were determined from synthetic crystals grown from aqueous solutions.

HIBBS, D.E., KOLITSCH, U., LEVERETT, P., SHARPE, J.L. & WILLIAMS, P.A. (2002): Hoganite and paceite, two new acetate minerals from the Potosi mine, Broken Hill, Australia. *Mineralogical Magazine* **66**, 459–464.

Karupmøllerite-Ca



MONOCLINIC

Locality: In the Mellemelv stream valley, Kangerluarsuk area, Ilímaussaq alkaline complex, South Greenland.

Occurrence: In a naujaite pegmatite. Associated minerals are: aegirine, arfvedsonite, eudialyte, potassic feldspar, sodalite, albite, carbonate-fluorapatite, lueshite, natrolite, and tuperssuatsiaite.

General appearance: Pseudomorphs after rectangular lamellae (up to $2 \times 1.5 \times 0.1$ cm) of epistolite replacing vuonnemite. The pseudomorphs are fine-grained aggregates with minor relics of epistolite.

Physical, chemical and crystallographic properties: *Luster:* vitreous to dull. *Diaphaneity:* translucent. *Color:* white with grayish and pinkish tints. *Streak:* not given but probably white. *Luminescence:* not mentioned. *Hardness:* 5. *Tenacity:* brittle. *Cleavage:* parting along the perfect {001} cleavage of the original vuonnemite/epistolite crystals. *Fracture:* not given. *Density:* 2.71 g/cm³ (meas.), 2.75 g/cm³ (calc.). **Crystallography:** Monoclinic, *C2/m*, *a* 14.641, *b* 14.214, *c* 7.9148 Å, β 117.36°, *V* 1463 Å³, *Z* = 2, *a:b:c* = 1.0300:1:0.5568. *Morphology:* no forms were observed; particles about 0.01 mm are irregular, platy. *Twinning:* none observed. **X-ray powder-diffraction data:** 7.104(73)(020), 7.026(100)(001), 6.482(45)(20 $\bar{1}$), 4.996(74)(021), 3.253(38)(42 $\bar{1}$), 3.250(36)(400), 3.242(34)(40 $\bar{2}$), 3.171(56)(041), 3.150(38)(022). **Optical data:** Biaxial (+), α 1.656, β 1.662, γ 1.755, *2V*(meas.) 30°, *2V*(calc.) 30°; dispersion not observed; nonpleochroic; orientation not given. **Chemical analytical data:** Mean of twelve sets of electron-microprobe data (H₂O by TGA): Na₂O 2.17, K₂O 1.74, CaO 6.00, MnO 0.31, ZnO 0.06, SrO 0.08, BaO 0.28, Al₂O₃ 0.25, Fe₂O₃ 0.47, SiO₂ 39.85, TiO₂ 8.51, Nb₂O₅ 29.92, H₂O 11.31, Total 100.95 wt.%. Empirical formula: (Na_{0.84}Ca_{0.64}K_{0.44}Ba_{0.02}Sr_{0.01}) Σ 1.95(Ca_{0.64}Mn_{0.05}Zn_{0.01}) Σ 0.70(Nb_{2.70}Ti_{1.28}Fe³⁺_{0.07}) Σ 4.05(Si_{7.97}Al_{0.06}) Σ 8.03O_{24.09}[O_{2.75}(OH)_{1.25}] Σ 4.00•6.92H₂O. **Relationship to other species:** It is a member of the labuntsovite group with Ca dominant at the *D* site.

Name: After Svend Karup-Møller (b. 1936), Associate Professor at the Technical University of Denmark; the suffix denotes the dominance of Ca at the *D* site.

Comments: IMA No. 2001-028. In the table giving the X-ray powder-diffraction data, twelve entries have redundant indices, all those with $0k\bar{l}$ being equivalent to $0kl$.

PEKOV, I.V., CHUKANOV, N.V., PETERSEN, O.V., ZADOV, A.E., YAMNOVA, N.A., KABALOV, Y.K. & SCHNEIDER, J. (2002): Karupmøllerite-Ca, (Na,Ca,K)₂Ca(Nb,Ti)₄(Si₄O₁₂)₂(O,OH)₄•7H₂O, a new mineral of the labuntsovite group from the Ilímaussaq alkaline complex, South Greenland. *Neues Jahrbuch für Mineralogie, Monatshefte*, 433-444.

CHUKANOV, N.V., PEKOV, I.V. & KHOMYAKOV, A.P. (2002): Recommended nomenclature for labuntsovite-group minerals. *European Journal of Mineralogy* **14**, 165-173.

Keilite

(Fe,Mg)S

CUBIC

Localities: The Abee enstatite chondrite meteorite found near Abee, Alberta, Canada (Lat. 53° 50'N, Long. 113° 15'W). The mineral also is present in the following meteorites: Adhi-Kot, Saint-Sauveur, LEW 88180, RKP A80259, LEW 87119, LEW 88714, Y-791790, Y-791811, Y-86760 and Y8404.

Occurrence: Associated minerals are: niningerite, enstatite, kamacite and troilite.

General appearance: Small grains up to several hundred micrometers across.

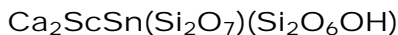
Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* not observed. *Streak:* not observed. *Hardness:* could not be measured. *Tenacity:* not determined. *Cleavage:* not observed. *Fracture:* not observed. *Density:* could not be measured, 3.59 to 3.67 g/cm³ (calc.). **Crystallography:** Cubic, *Fm*3*m*, *a* 5.20 Å, *V* 140.6 Å³, *Z* = 4. *Morphology:* no forms were observed. *Twinning:* none observed. **X-ray powder-diffraction data:** Only two spacings were measured: 2.584 and 1.829 (indexed as 200 and 220, respectively). Calculated spacings and indices are: 2.985(111), 2.585(200), 1.828(220), 1.492(222), 1.292(400), 1.156(420), 1.055(422), 0.914(440), 0.862(600), 0.817(620), 0.779(622). **Optical data:** In reflected light: gray, isotropic. *R:* (27.2%) 470 nm, (26.7%) 546 nm, (26.4%) 589 nm, (26.3%) 650 nm. **Chemical analytical data:** Six sets of electron-microprobe data are given. The data for the grain on which gave the reflectance data above were obtained are: Fe 39.57, Mg 10.36, Mn 3.43, Ca 1.86, Cr 1.98, Zn 0.30, Ti 0.09, Ni -, Cu 0.01, S 41.46, Total 99.06 wt.%. Empirical formula: (Fe_{0.55}Mg_{0.33}Mn_{0.05}Ca_{0.04}Cr_{0.03})_{Σ1.00}S_{1.00}. **Relationship to other species:** It is the Fe-dominant analogue of niningerite, (Mg,Fe)S.

Name: After Klaus Keil (b. 1934), Hawaii Institute of Geophysics and Planetology, University of Hawaii, Honolulu, Hawaii, USA.

Comments: IMA No. 2001-053. Because of the small grain-size, many of the usual physical properties could not be determined.

SHIMIZU, M., YOSHIDA, H. & MANDARINO, J.A. (2002): The new mineral species keilite, (Fe,Mg)S, the iron-dominant analogue of niningerite. *Canadian Mineralogist* **40**, 1687-1692.

Kristiansenite



TRICLINIC

Locality: The Heftetjern pegmatite, Tørdal area, Telemark, Norway.

Occurrence: In a granite pegmatite. Closely associated minerals are: quartz, albite, apatite and stilpnomelane. Other associated minerals are: scandiobabingtonite, scandian ixiolite, hingganite-(Y), cerian epidote, titanite, plumbomicrolite and other microlite minerals, bazzite, milarite, cassiterite and two unidentified tantalum minerals (ryneronite? and tantite?).

General appearance: Tapering crystals rarely up to 2 mm long and a massive aggregate nearly 2 mm across.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* translucent to transparent. *Color:* colorless, white or slightly yellowish. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 5½ to 6. *Tenacity:* brittle. *Cleavage:* {001} inferred from preferred orientation in the X-ray powder-diffraction pattern. *Fracture:* uneven. *Density:* could not be measured but sinks in di-iodomethane [3.3 g/cm³ (meas.), 3.64 g/cm³ (calc.)]. **Crystallography:** Triclinic, *C*1, *a* 10.028, *b* 8.408, *c* 13.339 Å, α 90.01, β 109.10, γ 90.00°, *V* 1062.7 Å³, *Z* = 4, *a:b:c* = 1.1927:1:1.5865. *Morphology:* no forms could be measured, but {010} is present. *Twinning:* polysynthetic on {010} with twin striations. **X-ray powder-diffraction data:** 5.18(53)(111), 3.898(12)(113), 3.146(100)(004), 3.089(63)(222), 2.901(19)(221), 2.595(34)(222), 2.142(17)(331), 1.433(12)(137). **Optical data:** Because of intensive twinning, no optical data could be determined except for a mean index of refraction, 1.74. **Chemical analytical data:** Forty-nine sets of electron-microprobe data were measured from several grains in three laboratories. The mean of eleven sets of electron-microprobe data (H₂O by difference) for the grain used for the crystal-structure study are: Na₂O 0.41, K₂O 0.06, CaO 18.45, Al₂O₃ 0.35, Sc₂O₃ 8.11, Fe₂O₃ 1.98, SiO₂ 40.76, TiO₂ 0.08, ZrO₂ 0.43, SnO₂ 27.33, H₂O (2.04), Total (100.00) wt.%. Empirical formula: (Ca_{0.96}Na_{0.04}) Σ 1.00(Sn_{0.53}Sc_{0.34}Fe_{0.07}Al_{0.02}Zr_{0.01}) Σ 0.97Si_{1.98}[O_{6.34}(OH)_{0.66}] Σ 7.00. Taking into consideration the crystal-structure data, the ideal formula is Ca₂ScSn(Si₂O₇)(Si₂O₆OH). **Relationship to other species:** None apparent.

Name: After Roy Kristiansen (b. 1943), a well-known amateur mineralogist from Norway who first noticed the new mineral and (with K. Eldjarn, A. Haugen and H.V. Ellingsen) provided samples for the study.

Comments: IMA No. 2000–051. Note that the crystal structure has been solved.

RAADE, G., FERRARIS, G., GULA, A., IVALDI, G. & BERNHARD, F. (2002): Kristiansenite, a new calcium – scandium – tin sorosilicate from granite pegmatite in Tørdal, Telemark, Norway. *Mineralogy and Petrology* **75**, 89-99.

FERRARIS, G., GULA, A., IVALDI, G., NESPOLO, M. & RAADE, G. (2001): Crystal structure of kristiansenite: a class IIB twinning by metric merohedry. *Zeitschrift für Kristallographie* **216**, 442-448.

Kurgantaite



TRICLINIC

Localities: Inder borate deposit, Kazakhstan. Also from the Chelkar borate deposit, Kazakhstan and the Nepskoe potassium deposit, Siberia, Russia.

Occurrence: Associated minerals are: sylvite, halite, boracite, anhydrite, magnesite and quartz.

General appearance: Fine-grained nodules up to 4 cm across, spherulites up to 0.7 mm in diameter (made up of individual crystals with pyramidal or wedge-shaped terminations) and poorly formed triangular plates up to 0.5 mm.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* colorless to white. *Streak:* white. *Luminescence:* probably nonfluorescent. *Hardness:* 6 to 6½. *Tenacity:* brittle. *Cleavage:* given as medium for two unspecified directions. *Fracture:* uneven. *Density:* 2.99 g/cm³ (meas.), 3.04 g/cm³ (calc.). **Crystallography:** Triclinic, *P*1, *a* 6.573, *b* 6.445, *c* 6.369 Å, α 60.995°, β 61.257°, γ 77.191°, *V* 206.9 Å³, *Z* = 1, *a:b:c* = 1.0199:1:0.9882. Morphology: no forms were mentioned. Twinning: none mentioned. **X-ray powder-diffraction data:** 5.69(8)(010), 3.22(9)(112,111,201), 3.13(7)(011,121), 2.92(10)(200), 2.84(9)(020), 2.79(8)(122), 2.14(7)(312,201), 2.07(7)(113). **Optical data:** Biaxial (+), α 1.637, β 1.638, γ 1.675, *2V*(meas.) <10°, *2V*(calc.) 19°, dispersion not given; nonpleochroic; orientation not given. **Chemical analytical data:** Seven sets of electron-microprobe data are given. One set from the Inder material consists of the following: CaO 14.69, SrO 26.43, B₂O₃ 45.31, H₂O 4.69, Cl 9.58, sum 100.70, less O = Cl 2.17, Total 98.53 wt.%. Empirical formula: Ca_{1.01}Sr_{0.98}(B_{5.00}O_{8.96})Cl_{1.04}•1.00H₂O. **Relationship to other species:** Related to hilgardite, Ca₂(B₅O₉)Cl•H₂O.

Name: Reflects the type locality.

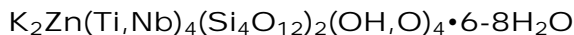
Comments: The mineral was originally described by Yarzhemskiy in 1952 but was discredited by von Hodenberg and Kühn in 1982 as "strontium hilgardite". Dr. Igor Pekov kindly assisted with this abstract. IMA case 00-B.

PEKOV, I.V., LOVSKAYA, E.V., CHUKANOV, N.V., ZADOV, A.E., APPOLONOV, V.N., PUSHCHAROVSKY, D.YU., FERRO, O. & VINOGRADOVA, S.A. (2001): Kurgantaite CaSr[B₅O₉]Cl•H₂O: re-validation of the mineral species and new data. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* **130**(3), 71-79 (in Russ.).

FERRO, O., PUSHCHAROVSKY, D.YU., TEAT, S., VINOGRADOVA, S.A., LOVSKAYA, E.V. & PEKOV, I.V. (2000): Crystal structure of strontium hilgardite. *Crystallography Reports* **45**, 410-415.

YARZHEMSKY, YA.YA. (1952): Kurgantaite – a new borate mineral. *Mineral. Sbornik, Lvov. Geol. Obshchestva, No. 6*, 169-174 (in Russ.).

Kuzmenkoite-Zn



MONOCLINIC

Localities: (1) Kedykverpakhk Mt., Lovozero massif, Kola Peninsula, Russia. (2) Lepkhe-Nelm Mt., Lovozero massif, Kola Peninsula, Russia. (3) Karnasurt Mt., Lovozero massif, Kola Peninsula, Russia.

Occurrence: In alkaline pegmatites. (1) Associated with natrolite, microcline, albite, aegirine, nepheline, arfvedsonite, sodalite, eudialyte, lorenzenite and others. (2) Associated with microcline, aegirine, nepheline, magnesioarfvedsonite, eudialyte, lorenzenite, lamprophyllite, catapleiite, titanite, vinogradovite, tundrite-(Ce), apatite, neptunite, other labuntsovite-group minerals and others. (3) Associated with natrolite, microcline, albite, aegirine, nepheline, arfvedsonite, sodalite, eudialyte, organovaite, beryllite, ranciéite, elpidite, strontiopyrochlore, catapleiite, yofortierite, manganneptunite, nontronite and others.

General appearance: (1) Pseudomorphs after murmanite. (2) Coarse prismatic crystals (up to 7×0.5 mm). (3) Rough crystals (up to $3 \times 0.5 \times 0.3$ mm).

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* translucent. *Color:* pink, pinkish-brown, gray, white. *Streak:* white. *Luminescence:* not mentioned. *Hardness:* ~5. *Tenacity:* brittle. *Cleavage:* not observed. *Fracture:* rough. *Density:* 2.78 to 2.87 g/cm³ (meas.), 2.94 g/cm³ (calc.). **Crystallography:** Monoclinic, *Cm*, *a* 14.400, *b* 13.851, *c* 7.781 Å, β 117.33°, *V* 1379 Å³, *Z* = 2, *a:b:c* = 1.0396:1:0.5618. Morphology: no forms were mentioned. Twinning: none mentioned. **X-ray powder-diffraction data:** 6.92(75)(020,001), 6.40(60)(201,200), 4.89(29)(021), 3.19(100)(421,402), 3.09(91)(041,022), 2.58(35)(241), 2.49(35)(441,403). **Optical data:** Biaxial (+), α 1.680 to 1.683, β 1.686 to 1.688, γ 1.783 to 1.787, *2V*(meas.) 25°, *2V*(calc.) 28°; dispersion not mentioned; nonpleochroic; *Y = b*. **Chemical analytical data:** Three sets of electron-microprobe data are given. The set for material from Kedykverpakhk (with H₂O determined by TGA) is: Na₂O 0.49, K₂O 5.69, MgO 0.03, CaO 2.19, MnO 2.07, FeO 0.54, ZnO 3.73, SrO 0.19, BaO 2.00, Al₂O₃ 0.10, SiO₂ 38.56, TiO₂ 17.68, Nb₂O₅ 12.54, H₂O 13.80, Total 99.61 wt.%. Empirical formula: (K_{1.48}Ca_{0.48}Na_{0.19}Ba_{0.16}Sr_{0.02}) Σ 2.33(Zn_{0.56}Mn_{0.36}Fe_{0.09}Mg_{0.01}) Σ 1.02(Ti_{2.71}Nb_{1.16}) Σ 3.87[(Si_{3.94}Al_{0.01}) Σ 3.95O_{11.85}]_{2.00}[(OH)_{2.19}O_{1.81}] Σ 4.00•8.30H₂O. **Relationship to other species:** It is a member of the kuzmenkoite subgroup of the labuntsovite group with Zn dominant at the *D* site.

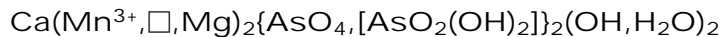
Name: After Maria V. Kuz'menko (1918–1995), Russian geochemist and mineralogist, a specialist in the geochemistry of rare elements, who studied the Lovozero massif; the suffix denotes the dominance of Zn at the *D* site.

Comments: IMA No. 2001–037. The subscripts in the empirical formula given here are quite different from those given by the authors.

CHUKANOV, N.V., PEKOV, I.V., ZADOV, A.E., AZAROVA, YU.V. & SEMENOV, E.I. (2002): Kuzmenkoite-Zn K₂Zn(Ti,Nb)₄(Si₄O₁₂)₂(OH,O)₄•6–8H₂O, a new mineral of the labuntsovite group from the Lovozero massif, Kola Peninsula. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* **131**(2), 45-50 (in Russ.).

CHUKANOV, N.V., PEKOV, I.V. & KHOMYAKOV, A.P. (2002): Recommended nomenclature for labuntsovite-group minerals. *European Journal of Mineralogy* **14**, 165-173.

Manganlotharmeyerite



MONOCLINIC

Locality: The Starlera Fe–Mn deposit, Val Ferrera, Eastern Alps, Switzerland.

Occurrence: In carbonate-hosted manganese ore. Associated minerals are: calcite, tilasite and sailaufite (in press).

General appearance: Elongate platy crystals and aggregates up to 1 mm long.

Physical, chemical and crystallographic properties: *Luster:* adamantine. *Diaphaneity:* transparent to translucent. *Color:* brown-red to dark reddish orange. *Streak:* light brown. *Luminescence:* not given. *Hardness:* about 3. *Tenacity:* brittle. *Cleavage:* {001} distinct. *Fracture:* irregular. *Density:* 3.77 g/cm³ (meas.), 3.75 g/cm³ (calc.). **Crystallography:** Monoclinic, C2/m, a 9.043, b 6.2314, c 7.3889 Å, β 116.392°, V 372.99 Å³, Z = 2, a:b:c = 1.4512:1:1.1858. Morphology: no forms were mentioned. Twinning: none mentioned. **X-ray powder-diffraction data:** 4.93(80)(110), 3.182(100)($\bar{1}$ 12), 2.927(70)(201), 2.822(70)(021), 2.718(80)($\bar{3}$ 11), 2.555(100)($\bar{2}$ 21, $\bar{3}$ 12), 2.134(70)(202,221). **Optical data:** Biaxial (+), α 1.785, β 1.814, γ 1.854, 2V(meas.) 85°, 2V(calc.) 82°; dispersion r < v, weak; pleochroism not mentioned; orientation unknown. **Chemical analytical data:** Mean of six sets of electron-microprobe data (H₂O calculated to give 10 oxygen atoms): Na₂O 0.08, MgO 3.95, CaO 12.42, ZnO 0.58, SrO 0.20, NiO 1.07, CoO 0.19, Al₂O₃ 0.27, Fe₂O₃ 0.91, Mn₂O₃ 16.70, V₂O₅ 0.67, As₂O₅ 53.41, H₂O (8.84), Total (99.29) wt.%. Empirical formula: (Ca_{0.94}Sr_{0.01}Na_{0.01})(Mn³⁺_{0.45}□_{0.26}Mg_{0.20}Ni_{0.03}Fe_{0.02}Zn_{0.02}Al_{0.01}Co_{0.01})₂(As_{0.98}V_{0.02})₂O_{10.00}H_{4.16}. **Relationship to other species:** It is the manganese-dominant member of the lotharmeyerite subgroup of the tsumcorite group.

Name: Reflects the relationship to lotharmeyerite.

Comments: IMA No. 2001–026. The crystal structure has been solved and is the basis for the formula given.

BRUGGER, J., KRIVOVICHEV, S.V., KOLITSCH, U., MEISSER, N., ANDRUT, M., ANSERMET, S. & BURNS, P.C. (2002): Description and crystal structure of manganlotharmeyerite, Ca(Mn³⁺, □, Mg)₂{AsO₄, [AsO₂(OH)₂]}₂(OH, H₂O)₂, from the Starlera Mn deposit, Swiss Alps, and a redefinition of lotharmeyerite. *Canadian Mineralogist* **40**, 1597–1608.

Megakalsilite



 HEXAGONAL

Locality: The Khibina alkaline massif, Kola Peninsula, Russia.

Occurrence: In a large body of hyperagpaitic pegmatite in ijolite-urtite, near their contact with apatite–nepheline rocks. Associated minerals are: cancrinite, sodalite and natrite (all of which are intergrown with megakalsilite), K-feldspar, natrolite, pectolite, aegirine, nacaphite, vitusite, fluorcaphite, belovite, umbite, lemmleinite-K, lomonosovite, lovozerite, phlogopite, sphalerite and galena.

General appearance: A corroded, anhedral grain 2 to 3 mm across.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* colorless. *Streak:* white. *Luminescence:* fluoresces pale whitish green in ultraviolet light (240 to 400 nm). *Hardness:* 6. *Tenacity:* brittle. *Cleavage:* none. *Fracture:* conchoidal. *Density:* 2.58 g/cm³ (meas.), 2.62 g/cm³ (calc.). **Crystallography:** Hexagonal, P6₃, a 18.104, c 8.467 Å, V 2403.3 Å³, Z = 24, c:a = 0.4677. Morphology: no forms were observed. Twinning: none mentioned. **X-ray powder-diffraction data:** 3.18(50)(141), 3.091(100)(222), 2.612(70)(060), 1.674(50)(173), 1.585(50)(282,225), 1.516(50)(145,660), 1.240(60)(4.10.1,066,583), 1.204(50)(4.10.2,285), 1.031(50)(666,228). **Optical data:** Uniaxial (-), ω 1.538, ε 1.531, nonpleochroic. **Chemical analytical data:** Mean of thirty sets of electron-microprobe data: Na₂O 0.02, K₂O 29.73, FeO 0.04, Al₂O₃ 32.38, SiO₂ 37.96, TiO₂ 0.01, Total 100.14 wt.%. Empirical formula: K_{1.00}Al_{1.00}Si_{1.00}O_{4.00}. **Relationship to other species:** It is a polymorph of KAlSiO₄.

Name: Reflects the relationship with kalsilite, the most common form of KAlSiO₄ in nature; the prefix mega (from the Greek μέγας) alludes to the much higher unit-cell volume of this mineral (2403 Å³) compared to that of kalsilite (200 Å³).

Comments: IMA No. 2001–008.

KHOMYAKOV, A.P., NECHELYUSTOV, G.N., SOKOLOVA, E., BONACCORSI, E., MERLINO, S. & PASERO, M. (2002): Megakalsilite, a new polymorph of KAlSiO₄ from the Khibina massif, Kola Peninsula, Russia: mineral description and crystal structure. *Canadian Mineralogist* **40**, 961–970.

Monazite-(Sm)



MONOCLINIC

Locality: Annie Claim #3 granitic pegmatite, 1.2 km northwest of Greer Lake, southeastern Manitoba, Canada (Lat. 50° 21' 12" N, Long. 95° 20' 18" W).

Occurrence: In a pegmatite. Associated minerals are: manganocolumbite, quartz, albite and lithian muscovite.

General appearance: Platy subhedral crystals up to 0.4 mm.

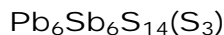
Physical, chemical and crystallographic properties: *Luster:* given as vitreous to slightly greasy, but the optical data indicate adamantine. *Diaphaneity:* translucent to transparent. *Color:* yellowish. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* could not be measured. *Tenacity:* brittle. *Cleavage:* one good direction. *Fracture:* uneven. *Density:* could not be measured, 5.51 g/cm³ (calc.). **Crystallography:** Monoclinic, $P2_1/n$, a 6.725, b 6.936, c 6.448 Å, β 104.02°, V 291.8 Å³, $Z = 4$, $a:b:c = 0.9696:1:0.9296$. Morphology: no forms were observed. Twinning: none mentioned. **X-ray powder-diffraction data:** 5.191(40)($\bar{1}01$), 4.647(50)(011), 4.164(80)($\bar{1}11$), 3.492(40B)(111,020), 3.264(70)(200), 3.065(100)(120), 2.857(90)($\bar{1}12,012$). **Optical data:** Biaxial (+), α 1.768, β 1.771, γ 1.818 (calc.), $2V(\text{meas.}) 29^\circ$, dispersion not mentioned; pleochroism not mentioned; $X = b$, $Y \wedge a = 5^\circ$ in obtuse angle β , $Z \wedge c = 9^\circ$ in obtuse angle β . **Chemical analytical data:** Mean of three sets of electron-microprobe data: CaO 2.75, PbO 2.14, Y₂O₃ 1.29, La₂O₃ 2.10, Ce₂O₃ 10.04, Pr₂O₃ 1.58, Nd₂O₃ 6.03, Sm₂O₃ 13.02, Gd₂O₃ 12.06, Tb₂O₃ 1.14, Dy₂O₃ 1.18, Yb₂O₃ 0.02, Lu₂O₃ 0.05, ZrO₂ 0.71, ThO₂ 16.27, UO₂ 0.62, SiO₂ 1.53, P₂O₅ 27.48, Total 100.01 wt.%. Empirical formula: (Sm_{0.18}Gd_{0.16}Th_{0.15}Ce_{0.15}Ca_{0.12}Nd_{0.09}La_{0.03}Y_{0.03}Pb_{0.02}Pr_{0.02}Tb_{0.02}Dy_{0.02}Zr_{0.01}U_{0.01}) Σ 0.97 [(PO₄)_{0.94}(SiO₄)_{0.06}] Σ 1.00. **Relationship to other species:** It is the Sm-dominant member of the monazite series.

Name: Reflects the relationship to the monazite series.

Comments: IMA No. 2001-001.

MASAU, M., ČERNÝ, P., COOPER, M.A., CHAPMAN, R. & GRICE, J.D. (2002): Monazite-(Sm), a new member of the monazite group from the Annie Claim #3 granitic pegmatite, southeastern Manitoba. *Canadian Mineralogist* **40**, 1649-1655.

Moëloite



ORTHORHOMBIC

Locality: The Ceragiola marble quarry, near the small town of Seravezza, in Versilia, at the southern rim of the Apuan Alps, province of Lucca, northern Tuscany, about 35 km north of Pisa, Italy. The Seravezza area is 20 km southwest of Carrara.

Occurrence: In small cavities within marble. Associated minerals are: sulfur, pyrite and enargite. In these cavities, many other sulfosalts have been found: guettardite, robinsonite, zinkenite, boulangerite, semseyite, jordanite, tetrahedrite, sulvanite, colusite, famatinite and k esterite.

General appearance: Very thin, needle-like crystals (up to $0.1 \times 0.1 \times 5$ mm) or as soft plumose aggregates of flexible thin fibers up to 5 mm long.

Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* grayish black to brownish red. *Streak:* brown. *Hardness:* could not be determined. *Tenacity:* flexible. *Cleavage:* not observed. *Fracture:* not given. *Density:* could not be measured, 5.87 g/cm^3 (calc.). **Crystallography:** Orthorhombic, $P2_122_1$, a 15.328, b 4.0400, c 23.054  , V 1427.6  ³, $Z = 2$, $a:b:c = 3.7941:1:5.7064$. Morphology: no forms were identified; elongate on [010]. Twinning: none observed. **X-ray powder-diffraction data:** 3.724(55)(106), 3.427(100)(403), 3.047(85)(312), 2.844(58)(503), 2.779(70)(016), 2.753(45)(116), 2.017(80)(614), 1.733(50)(0.1.12). **Optical data:** In reflected light: white, moderate anisotropism, nonpleochroic; rare red internal reflections in oil. R_1 , R_2 ; ${}^{\text{im}}R_1$, ${}^{\text{im}}R_2$: (40.0, 37.8; 26.6, 24.2%) 470 nm, (38.8, 36.5; 24.9, 22.8%) 546 nm, (38.6, 36.7; 23.4, 21.4%) 589 nm, (36.5, 34.7; 21.2, 20.1%) 650 nm. **Chemical analytical data:** Mean of four sets of electron-microprobe data: Pb 48.94, Sb 29.47, S 21.76, Total 101.17 wt.%. Empirical formula: $\text{Pb}_{6.02}\text{Sb}_{6.04}\text{S}_{16.94}$. **Relationship to other species:** None apparent, but it is the natural analogue of synthetic material.

Name: After Yves Mo lo (b. 1949), Institut des Mat riaux de Nantes, France, in recognition of his contributions to lead sulfosalt mineralogy. He also characterized the synthetic equivalent of this phase.

Comments: IMA No. 1998-045.

ORLANDI, P., MEERSCHAUT, A., PALVADEAU, P. & MERLINO, S. (2002): Lead-antimony sulfosalts from Tuscany (Italy). V. Definition and crystal structure of mo loite, $\text{Pb}_6\text{Sb}_6\text{S}_{14}(\text{S}_3)$, a new mineral from the Ceragiola marble quarry. *European Journal of Mineralogy* **14**, 599-606.

Mottanaite-(Ce)



MONOCLINIC

Locality: Monte Cavalluccio, Sacrofano, north of Rome, Italy.

Occurrence: In miarolitic cavities in a feldspathoid-bearing alkali syenitic ejectum from the "lower pyroclastic flow" of the Sabatini volcanic complex. The only associated mineral noted is britholite-(Ce), with which it is intergrown.

General appearance: Small (<0.5 mm) tabular crystals.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* translucent to transparent. *Color:* brown to pale brown. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* not given. *Tenacity:* brittle. *Cleavage:* absent. *Fracture:* conchoidal. *Density:* 3.61 g/cm³ (meas.), 3.88 g/cm³ (calc.). **Crystallography:** Monoclinic, *P2/a*, *a* 19.032, *b* 4.746, *c* 10.248 Å, β 110.97°, *V* 864.3 Å³, *Z* = 2, *a:b:c* = 4.0101:1:2.1593. *Morphology:* {010}, tabular. *Twinning:* none observed. **X-ray powder-diffraction data:** 3.452(67)($\bar{2}$ 12), 3.243(80)(410), 3.085(85)($\bar{4}$ 12), 2.916(86)(212), 2.854(100)(411), 2.647(84)(013), 2.646(86)($\bar{4}$ 13), 2.635(84)($\bar{6}$ 11). **Optical data:** Biaxial (-), α 1.680, β 1.694, γ 1.708, *2V*(meas.) 90°, *2V*(calc.) 89°; dispersion not given; nonpleochroic; orientation not given. **Chemical analytical data:** Mean of two to four sets of electron-microprobe data (light elements by SIMS): Li₂O 0.037, Na₂O 0.00, BeO 2.94, MgO 0.140, CaO 24.46, BaO 0.002, B₂O₃ 13.85, Al₂O₃ 2.53, Cr₂O₃ 0.00, Mn₂O₃ 0.00, Fe₂O₃ 3.06, Y₂O₃ 0.073, La₂O₃ 7.42, Ce₂O₃ 12.63, Pr₂O₃ 1.103, Nd₂O₃ 2.36, Sm₂O₃ 0.137, Eu₂O₃ 0.020, Gd₂O₃ 0.094, Dy₂O₃ 0.024, Er₂O₃ 0.005, Yb₂O₃ 0.002, SiO₂ 23.85, TiO₂ 0.560, ThO₂ 4.01, UO₂ 0.430, H₂O 0.390, F 1.00, sum 101.13, less O = F 0.42, Total 100.71 wt.%. Empirical formula: Ca_{4.00}[(REE)_{1.47}Ca_{0.37}Th_{0.15}U_{0.02}] Σ _{2.01}(Al_{0.50}Fe³⁺_{0.38}Ti_{0.07}Mg_{0.03}) Σ _{0.98}(Be_{1.18}Li_{0.02}) Σ _{1.20}B_{3.99}Si_{3.98}O_{22.00}[O_{1.04}F_{0.53}(OH)_{0.43}] Σ _{2.00}. **Relationship to other species:** It is a member of the hellandite group.

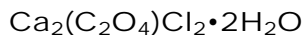
Name: After Annibale Mottana (b. 1940), Professor of Mineralogy at the Università di Roma Tre, Italy.

Comments: IMA No. 2000-020.

DELLA VENTURA, G., BONAZZI, P., OBERTI, R. & OTTOLINI, L. (2002): Ciprianiite and mottanaite-(Ce), two new minerals of the hellandite group from Latium (Italy). *American Mineralogist* **87**, 739-744.

OBERTI, R., DELLA VENTURA, G., OTTOLINI, L., HAWTHORNE, F.C. & BONAZZI, P. (2002): Re-definition, nomenclature and crystal-chemistry of the hellandite group. *American Mineralogist* **87**, 745-752.

Novgorodovaite



MONOCLINIC

Locality: The Chelkar salt dome, western Kazakhstan.

Occurrence: In evaporite rock. Associated minerals are: anhydrite, gypsum, halite, bischofite, magnesite and hilgardite.

General appearance: aggregates (up to 3 cm) of grains (up to 7 mm).

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* colorless. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 2½. *Tenacity:* brittle. *Cleavage:* {100} and {010} medium. *Fracture:* uneven. *Density:* 2.38 g/cm³ (meas.), 2.40 g/cm³ (calc.). **Crystallography:** Monoclinic, *I2/m*, *a* 6.936, *b* 7.382, *c* 7.443 Å, β 94.3°, *V* 380.0 Å³, *Z* = 2, *a:b:c* = 0.9396:1:1.0083. Morphology: equant. Twinning: none observed. **X-ray powder-diffraction data:** 5.062(7)(110), 4.812(5)(101), 4.323(7)(11̄1), 4.063(7)(111), 3.644(5)(020), 2.956(8)(21̄1), 2.917(10)(112). **Optical data:** Biaxial (-), α 1.565, β 1.645, γ 1.725, 2*V*(meas.) 88°, 2*V*(calc.) 86°; dispersion not observed; *Y = b*, *Z* ∧ *c* = 40° (synthetic). **Chemical analytical data:** Analysis (Ca and Cl by electron microprobe, C and H by selective sorption of combustion products in oxygen, O by difference) gave: Ca 29.43, Cl 24.56, H 1.67, C 8.53, O (35.81), Total (100.00) wt.%. Empirical formula: Ca_{1.83}(C₂O₄)_{1.77}Cl_{1.72}•2.06H₂O. **Relationship to other species:** It is an oxalate.

Name: After Margarita Ivanovna Novgorodova (b. 1938), well-known Russian mineralogist and director of the Fersman Mineralogical Museum of the Russian Academy of Sciences.

Comments: IMA No. 2000-039. The crystal structure has been solved.

CHUKANOV, N.V., BELAKOVSKIY, D.I., RASTSVETAeva, R.K., KARIMOVA, O.V. & ZADOV, A.E. (2001): Novgorodovaite Ca₂(C₂O₄)Cl₂•2H₂O, a new mineral. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* **130**(4), 32-35 (in Russ.).

RASTSVETAeva, R.K., CHUKANOV, N.V. & NEKRASOV, YU.V. (2001): Crystal structure of novgorodovaite Ca₂(C₂O₄)Cl₂•2H₂O. *Doklady Akademiyi Nauk* **381**(3), 353-355 (in Russ.).

Paceite



TETRAGONAL

Locality: The Potosi silver – lead – zinc deposit, 2 km northeast of Broken Hill, New South Wales, Australia (Lat. 31° 56'S, Long. 141° 30'E).

Occurrence: In gossan near a mass of decomposing leaves. Associated minerals are: goethite, hematite, quartz, linarite, malachite, azurite, cuprian smithsonite, cerussite and hoganite.

General appearance: Short, prismatic crystals (up to 1 mm across).

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* translucent. *Color:* deep sky blue. *Streak:* pale blue. *Luminescence:* nonfluorescent. *Hardness:* 1½. *Tenacity:* brittle. *Cleavage:* {100} and {110} perfect. *Fracture:* uneven. *Density:* 1.49 g/cm³ (calc.). **Crystallography:** Tetragonal, *I4/m*, *a* 11.155, *c* 16.226 Å, *V* 2020.13 Å³, *Z* = 4, *c/a* = 1.4555. *Morphology:* {100}, {001} and {111}. *Twinning:* none observed. **X-ray powder-diffraction data:** 9.297(6)(101), 8.132(8)(002), 7.896(100)(110), 5.586(15)(200), 3.530(20)(310), 3.042(3)(321), 2.497(4)(420). **Optical data:** Uniaxial (+), ω 1.439, ε 1.482, pleochroism O bluish with a grayish tint, E pale bluish with a grayish tint, $O \geq E$. See Comments. **Chemical analytical data:** Wet-chemical analysis by AAS (Ca), CHN analyzer (C and H) and O by difference gave: C 21.25, H 5.3, Cu 14.1, Ca 9.0, O (50.35), Total (100.00) wt.%. Empirical formula: $\text{Ca}_{1.02}\text{Cu}_{1.00}(\text{CH}_3\text{COO})_{4.00} \cdot 5.87\text{H}_2\text{O}$. **Relationship to other species:** It is an acetate.

Name: After Frank L. Pace (b. 1948), of Broken Hill, New South Wales, Australia, an ex-miner and well-known collector of Broken Hill minerals, who drew the mineral to the attention of the describers.

Comments: IMA No. 2001-030. Owing to the very small amount of natural material, the optical properties were determined from synthetic crystals grown from aqueous solutions. Determination of the crystal structure was not attempted.

HIBBS, D.E., KOLITSCH, U., LEVERETT, P., SHARPE, J.L. & WILLIAMS, P.A. (2002): Hoganite and paceite, two new acetate minerals from the Potosi mine, Broken Hill, Australia. *Mineralogical Magazine* **66**, 459-464.

Potassic-chloropargasite



MONOCLINIC

Locality: Elgoras Mt., Sal'nye Tundry, Kola Peninsula, Russia.

Occurrence: In the granulite complex of the massif. Associated minerals are: chlorapatite, almandine, diopside, enstatite, chlorian biotite, potassic pargasite, marialite and plagioclase.

General appearance: Grains up to 0.5 mm.

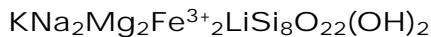
Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* opaque. *Color:* black. *Streak:* olive green. *Luminescence:* nonfluorescent. *Hardness:* 5½. *Tenacity:* brittle. *Cleavage:* {110} perfect. *Fracture:* uneven. *Density:* 3.29 g/cm³ (meas.), 3.36 g/cm³ (calc.). **Crystallography:** Monoclinic, *C2/m*, *a* 9.843, *b* 18.130, *c* 5.362 Å, β 105.5°, *V* 922.1 Å³, *Z* = 2, *a:b:c* = 0.5429:1:0.2958. Morphology: no forms were mentioned, habit equant. Twinning: none observed. **X-ray powder-diffraction data:** 8.42(8)(110), 3.116(3)(310), 2.951(3)(151,221), 2.714(10)(151), 2.562(7)(241), 1.444(3)(533). See Comments. **Optical data:** Biaxial (-), α 1.675, β 1.687, γ 1.690, 2*V*(meas.) 65°, 2*V*(calc.) 53°; dispersion *r* >< *v*, strong, moderate, weak; pleochroism *X* light gray, *Y* gray, *Z* dark green, *X* < *Y* < *Z*; *Y* = *b*. **Chemical analytical data:** Mean of unstated sets of electron-microprobe data: Na₂O 1.22, K₂O 3.03, MgO 9.08, CaO 11.41, FeO 16.63, Al₂O₃ 15.05, SiO₂ 38.71, TiO₂ 0.26, H₂O 0.84, Cl 4.33, sum 100.56, less O = Cl 0.98, Total 99.58 wt.%. Empirical formula: K_{0.60}Na_{0.37}Ca_{1.91}(Fe_{2.17}Mg_{2.11}Al_{0.82}Ti_{0.03})Σ_{5.13}(Si_{6.05}Al_{1.95}O_{21.98})[Cl_{1.15}(OH)_{0.87}]Σ_{2.02}. See Comments. **Relationship to other species:** It is a member of the amphibole group, calcic subgroup.

Name: Reflects the composition within the amphibole classification.

Comments: IMA No. 2001-036. The paper gives the formula with Mg > Fe, but the calculations show that the atomic proportion of Fe is slightly higher than that of Mg; the formula given here shows Fe > Mg. The strongest lines of the X-ray powder-diffraction data given in the paper's abstract are quite different from those given in Table 2 of the paper. The former match those given in the IMA proposal and are presented here.

CHUKANOV, N.V., KONILOV, A.N., ZADOV, A.E., BELAKOVSKIY, D.I. & PEKOV, I.V. (2002): The new amphibole potassic-chloropargasite (K,Na)Ca₂(Mg,Fe²⁺)₄Al(Si₆Al₂O₂₂)(Cl,OH)₂ and conditions of its formation in the granulite complex of Sal'nye Tundry massif (Kola Peninsula). *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* **131**(2), 58-62 (in Russ.).

Potassicleakeite



MONOCLINIC

Locality: Tanohata mine, Iwate Prefecture, Japan.

Occurrence: In pegmatite-like veinlets in a manganese ore deposit. Associated minerals are: quartz, K-feldspar, vanadium-dominant mangan-neptunite, suzukiite, roscoelite and sérandite.

General appearance: Prismatic crystals (up to 2 mm long and 0.2 mm wide).

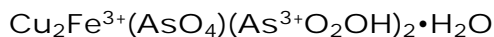
Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* reddish brown. *Streak:* pale brownish yellow. *Luminescence:* not mentioned. *Hardness:* VHN₁₀₀ 425 to 572 kg/mm², Mohs about 5. *Tenacity:* brittle. *Cleavage:* {110} perfect. *Fracture:* uneven. *Density:* not measured, 3.18 g/cm³ (calc.). **Crystallography:** Monoclinic, *C2/m*, *a* 9.922, *b* 17.987, *c* 5.286 Å, β 104.07°, *V* 915.1 Å³, *Z* = 2, *a:b:c* = 0.5516:1:0.2939. Morphology: no forms were mentioned; elongate on [001]. Twinning: none mentioned. **X-ray powder-diffraction data:** 8.48(67)(110), 4.50(89)(040), 3.40(46)(131), 3.28(45)(240), 3.16(72)(310,201), 2.83(49)(330), 2.74(44)(331), 2.71(41)(151), 2.53(100)(202). **Optical data:** Biaxial (+), α 1.672, β 1.680, γ 1.692, 2*V* not measured, 2*V*(calc.) 79°; dispersion not given; pleochroism distinct, *X* yellowish brown, *Y* pale brown, *Z* reddish brown; *X* ∧ *c* = 35 to 40° in obtuse angle β, *Y* ∧ *a* = 21 to 26° in acute angle β, *Z* = *b*. **Chemical analytical data:** Mean of six sets of electron-microprobe data and three sets of LAM-ICP-MS data (H₂O calculated to give 2 OH): Li₂O 1.20, Na₂O 8.73, K₂O 3.10, MgO 7.23, CaO 0.13, MnO 7.81, Al₂O₃ 0.44, V₂O₃ 5.52, Fe₂O₃ 9.45, SiO₂ 55.34, TiO₂ 0.29, H₂O (2.08), Total (101.32) wt.%. Empirical formula: (K_{0.57}Na_{0.46})Σ1.03(Na_{1.98}Ca_{0.02})Σ2.00(Mg_{1.29}Mn_{0.65})Σ1.94(Fe³⁺_{1.02}V_{0.64}Mg_{0.26}Al_{0.05}Ti_{0.03})Σ2.00(Li_{0.70}Mn_{0.30})Σ1.00(Si_{7.98}Al_{0.02})Σ8.00O_{22.00}(OH)_{2.00}. **Relationship to other species:** It is a member of the amphibole group, specifically the sodic subgroup, and it is the K-dominant analogue of leakeite, NaNa₂Mg₂Fe³⁺₂LiSi₈O₂₂(OH)₂.

Name: Reflects the relationship with leakeite.

Comments: IMA No. 2001-049.

MATSUBARA, S., MIYAWAKI, R., KUROSAWA, M. & SUZUKI, Y. (2002): Potassicleakeite, a new amphibole from the Tanohata mine, Iwate Prefecture, Japan. *Journal of Mineralogical and Petrological Sciences* **97**, 177-184.

Radovanite



ORTHORHOMBIC

Locality: The Roua copper deposits, upper Var valley (the Daluis gorge) at the western margin of the Barrot Dome, Alpes-Maritimes, France.

Occurrence: In a gangue made up of dolomite, calcite and aragonite, which consists of copper, cuprite, domeykite, algodonite, koutekite, and gold. Associated minerals are: cuprite, copper, malachite, trippkeite, olivenite, and algodonite.

General appearance: Aggregates (up to 2 mm in diameter) formed by small crystals up to $0.15 \times 0.08 \times 0.02$ mm.

Physical, chemical and crystallographic properties *Luster:* given as vitreous but the optical data indicate adamantine. *Diaphaneity:* transparent. *Color:* pistachio green. *Streak:* green. *Luminescence:* nonfluorescent. *Hardness:* could not be measured. *Tenacity:* brittle. *Cleavage:* none. *Fracture:* conchoidal. *Density:* 3.9 g/cm^3 (meas.), 3.79 g/cm^3 (calc.). **Crystallography:** Orthorhombic, *Pnma*, *a* 9.585, *b* 13.143, *c* 8.0884 Å, *V* 1018.9 Å³, *Z* = 4, *a:b:c* = 0.7293:1:0.6154. Morphology: {101}, {011}, {001}, {010}, {hk0} and {hkl}; habit equidimensional or slightly elongate along [100] or [010]. Twinning: none observed. **X-ray powder-diffraction data:** 6.88(25)(011), 6.179(90)(101), 3.871(20)(220), 3.241(40)(122), 3.090(100)(202), 2.710(25)(240,321), 2.551(20)(042), 2.214(25)(251,223). **Optical data:** Biaxial (-), α 1.80, β 1.84, γ 1.86, $2V$ (meas.) 65° , $2V$ (calc.) 69° ; dispersion not mentioned; pleochroism moderate, *X* light green to colorless, *Y* yellow green, *Z* pistachio green; orientation, *X* = *c*, *Y* = *a*, *Z* = *b*. **Chemical analytical data:** Mean of four sets of electron-microprobe data (with H₂O by difference): CuO 26.3, Fe₂O₃ 12.7, Al₂O₃ 0.04, P₂O₅ 0.3, As₂O₅ 19.93, As₂O₃ 34.32, H₂O (6.41), Total (100.00) wt.%. Empirical formula: $\text{Cu}_{1.92}\text{Fe}^{3+}_{0.93}[(\text{AsO}_4)_{1.01}(\text{PO}_4)_{0.02}]_{\Sigma 1.03}(\text{As}^{3+}\text{O}_2\text{OH})_{2.02}\cdot 1.06\text{H}_2\text{O}$. **Relationship to other species:** It has structural motifs similar to those in lironite, $\text{Cu}_2\text{Al}(\text{AsO}_4)(\text{OH})_4\cdot 4\text{H}_2\text{O}$.

Name: After Radovan Černý (b. 1957), crystallographer at the University of Geneva, Geneva, Switzerland.

Comments: IMA No. 2000-001.

SARP, H. & GUENEE, L. (2002): Radovanite, $\text{Cu}_2\text{Fe}^{3+}(\text{AsO}_4)(\text{As}^{3+}\text{O}_2\text{OH})_2\text{H}_2\text{O}$, a new mineral: its description and crystal structure. *Archives des Sciences de Genève* **55**(1), 47-55.

Reidite



TETRAGONAL

Localities: An impact ejecta layer at three sites on the upper continental slope off New Jersey, USA: Deep Sea Drilling Project Site 612, Ocean Drilling Program Hole 903C and Ocean Drilling Program Hole 904A. Several shocked crystals of zircon containing reidite have been found on the island of Barbados in what is considered to be the same layer of ejecta.

Occurrence: A layer of impact ejecta. Associated minerals are: impact glass, quartz, feldspar, coesite, stishovite, pyrite and glauconite. Heavy-mineral concentrates consist of Fe and Ti oxides (probably mixtures of ilmenorutile and ilmenite), garnet (mostly Fe-rich), staurolite, rutile, epidote, ilmenite, zircon, titanite, Al-rich phases (including kyanite) and tourmaline.

General appearance: Elongate skeletal crystals (up to 10 μm long and 0.3 μm wide) in shocked crystals of zircon (up to 80 \times 200 \times 200 μm).

Physical, chemical and crystallographic properties: See Comments. *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* pale brownish green. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 7½. *Tenacity:* brittle. *Cleavage:* none observed. *Fracture:* irregular. *Density:* could not be measured, $\sim 5.2 \text{ g/cm}^3$ (calc.). **Crystallography:** Tetragonal, I_4_1/a , a 4.738, c 10.506 Å, V 235.84 Å³, Z = 4, $c:a$ = 2.2174. Morphology: no forms were mentioned. Twinning: none mentioned. See Comments. **X-ray powder-diffraction data:** for synthetic material, 4.30(25)(101), 2.811(100)(112), 2.067(20)(211), 1.754(20)(204), 1.437(20)(132). **Optical data:** Uniaxial (+), indices of refraction >1.64, non-pleochroic. **Chemical analytical data:** Mean of five sets of electron-microprobe data: MgO 0.09, FeO 0.09, Al₂O₃ 0.01, SiO₂ 31.44, TiO₂ 0.06, ZrO₂ 65.92, HfO₂ 1.25, Total 98.86 wt.%. Empirical formula: (Zr_{1.00}Hf_{0.01})Si_{0.98}O_{4.00}. **Relationship to other species:** It is a polymorph of ZrSiO₄.

Name: After Allen F. Reid (b. 1931), who first produced this high-pressure phase.

Comments: IMA No. 2001-013. Many of the physical properties listed above are for synthetic material. Reidite has the scheelite structure.

GLASS, B.P., LIU, S. & LEAVENS, P.B. (2002): Reidite: an impact-produced high-pressure polymorph of zircon found in marine sediments. *American Mineralogist* **87**, 562-565.