

New Mineral Names*

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ANKINOVICHITE

Karpenko, V. Yu., Pautov, L. A., Sokolova, E. V., Hawthorne, F. G., Agakhanov, A. A., Dikaya, T. V., Bekenova, G. K. (2004) Ankinovichite, the nickel analogue of alvanite, a new mineral from Kurumsak (Kazakhstan) and Kara-Chagyr (Krygyzstan). *Zapiski Vseross. Mineral. Obshch.* 133(2), 59–70 (in Russian, English abstract).

Ankinovichite is described from two localities—Kurumsak, Chminken Oblasy, Kazakhstan, and Mount Kara-Chagyr, Osh Oblast, Krygyzstan). The material from Kurumsak occurs as crusts of prismatic, pale green, elongate crystals up to 0.5 mm. The material from Mount Kara-Chagyr occurs as green to light blue, tabular, commonly elongate crystals 0.05 to 0.2 mm in length. The crystals often occur in aggregates, and are commonly twinned. Ankinovichite is brittle, with perfect (010) cleavage, Mohs hardness 2.5 to 3, microindentation hardness VHN 68 kg/mm². The mineral is transparent and vitreous. Electron microprobe analyses (Kara-Chagyr/Kurumsak) gave Al₂O₃ 33.82/33.79, SiO₂ 0.59/0.67, V₂O₅ 28.41/27.98, FeO 0.14/0.35, NiO 8.43/7.19, CuO 0.27/0.20, ZnO 2.24/4.20, H₂O 23.30 (Penfield method)/25.65 (by difference), sum 97.20/100.00 wt%, corresponding to (Ni_{0.68}Zn_{0.17}Cu_{0.02}Fe_{0.01})_{20.88}Al₄(VO₃)_{1.88}Si_{0.06}(OH)_{12.12}(H₂O)_{2.67} for material from Kara-Chagyr and (Ni_{0.58}Zn_{0.31}Cu_{0.02}Fe_{0.03})_{20.94}Al₄(VO₃)_{1.85}Si_{0.06}(OH)_{12.27}(H₂O)_{2.46} for material from Kurumsak. The simplified general formula is (Ni,Zn)Al₄(VO₃)₂(OH)₁₂·2H₂O based on 4 Al atoms pfu. The IR spectrum of ankinovichite contains bands at 3570, 3460, and 3175, 1735, and 1620 cm⁻¹, as well as less intense bands in the range from 1025 to 465 cm⁻¹. Neither a discussion of the IR spectrum nor identification of the absorption bands is given. It is biaxial negative, $\alpha = 1.653(2)$, $\beta = 1.677(2)$, $\gamma = 1.706(3)$, $2V_{\text{obs}} = 86(2)^\circ$, $2V_{\text{calc}} = 86^\circ$. Ankinovichite has parallel extinction, positive elongation, is non-pleochroic and non-fluorescent under UV radiation.

The crystal structure of ankinovichite was refined on a 0.06 × 0.004 × 0.006 mm crystal by single-crystal X-ray diffraction methods, $R_1 = 0.128$ for 1143 reflections with $I > 4\sigma(I)$. Starting parameters were taken from alvanite (Dunn et al. 1990; *Mineral. Mag.* 54, 609–611; Pertlik et al. 1990; *Neues Jahrb. Mineral. Mh.* 385–392). The mineral is monoclinic, $P21/n$, $a =$

17.8098(8), $b = 5.1228(2)$, $c = 8.8665(4)$ Å, $\beta = 92.141(1)^\circ$, $V = 808.4(2)$ Å³, $Z = 2$, $D_{\text{obs}} = 2.48(2)$ g/cm³, $D_{\text{calc}} = 2.476$ g/cm³. The strongest lines on the powder X-ray diffraction pattern (FeK α radiation, 34 lines) are 8.89(100,200), 7.83(100,101), 5.01(30,301), 4.91(20,110), 3.354(40,012), 3.266(50,501), 2.944(30,312), 2.631(20,412), 2.463(20,701,220), 2.378(30,313,221), 2.323(30,313), 1.970(80,613,422), 1.935(20,023), 1.904(70,621), 1.680(40,820), 1.605(50,623), 1.539(30,804,332). The mineral is isostructural with alvanite and is its Ni analogue. The high R_1 value is thought to be due to twinning, although the refined site occupancies match well with those obtained by electron microprobe analyses. Ankinovichite is only the second mineral known to have chains of V tetrahedra.

Ankinovichite was found in the vanadium-bearing schists of the Kara-Tau range, south Kazakhstan. It is a low-temperature hydrothermal or supergene mineral, forming after earlier sphalerite, tetrahedrite, sulvanite, patronite, and breithauptite. At Kurumsak, ankinovichite was found in a dump at a bore pit within a middle Cambrian schist rich in carbonaceous material and clay and interbedded with dolomites. It is associated with volborthite, carnotite, goethite and an unknown dark orange V oxide. Ankinovichite at Kara-Chagyr (Isfayramsay River, Osh Oblast') occurs in fractures and as a cement in schist fragments (early Paleozoic) found within a serpentinite matrix, part of the early Carboniferous Fergana complex. It is associated with allophone, kolovratite, volborthite, nickelalumite, metatyuyamunite, roscoelite and tangeite. Ankinovichite was named for Ekaterina Aleksandrovna Ankinovich (1911–1991) and Stepane Gerasimoviche Ankinovich (1912–1985), a well-known mineralogist and geologist, respectively. The type material has been deposited at the A.E. Fersman Mineralogical Museum, Russian Academy of Science, Moscow, Russia (catalogue no. 6798). **P.C.P./T.S.E.**

Discussion. The authors state that they succeeded in locating two hydrogen atoms of the H₂O group although this seems unlikely given the poor quality of the final refinement.

BARI-OLGITE*

Pekov, I. V., Chukanov, N. V., Kulikova, I. M., Zubkova, N. V., Krotova, O. D., Sorokina, N. I., Pushcharovsky, D. S. (2004) A new mineral, bari-oligite Ba(Na,Sr,REE)₂Na[PO₄]₂, and its crystal structure. *Zapiski Vseross. Mineral. Obshch.* 133(1), 41–49 (in Russian, English abstract).

Bari-oligite occurs as irregular, isometric or flattened crystals, sometimes with a hexagonal outline, up to 1.5 × 1.0 cm. The crystals are transparent, light green, with a white streak

* Before publication, minerals marked with an asterisk were approved by the Commission on New Minerals and Mineral Names, International Mineralogical Association.

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and a vitreous luster. The dominant forms are trigonal prisms $\{\{100\}, \{\bar{1}00\}\}$ and trigonal pyramids $\{\{101\}, \{\bar{1}01\}, \{10\bar{1}\}, \text{and } \{\bar{1}0\bar{1}\}\}$. They often resemble quartz crystals. It fluoresces bright pink-orange in short-wave and weak pink-red in long-wave UV radiation. Bari-oligite is brittle, has uneven fracture, a Mohs hardness of 4 to 4.5, and imperfect (00*l*) and (*hk*0) cleavage. Electron microprobe analyses gave Na₂O 14.78, K₂O 0.87, CaO 0.32, SrO 16.57, BaO 31.17, MnO 0.39, La₂O₃ 2.41, Ce₂O₃ 1.90, Pr₂O₃ 0.10, Nd₂O₃ 0.16, SiO₂ 0.08, P₂O₅ 31.77, sum 100.52 wt%, corresponding to (Na_{2.14}K_{0.08}Ca_{0.03}Mn_{0.02}Sr_{0.72}Ba_{0.91}La_{0.07}Ce_{0.05})_{Σ4.02}P_{2.01}O₈ based on 8 oxygen atoms pfu. The simplified general formula is Ba(Na,Sr,REE)₂Na[PO₄]₂. The IR spectrum of bari-oligite is simple, containing only three absorption bands in the region 400–1200 cm⁻¹: 1035, 946, and 563 cm⁻¹. The mineral is uniaxial negative, $\epsilon = 1.623(3)$, $\omega = 1.628(2)$. It is colorless and non-pleochroic.

The crystal structure of the mineral was refined by single-crystal X-ray diffraction methods, $R_1 = 0.038$ for 601 reflections with $I > 4\sigma(I)$. The mineral is trigonal, $P3$, $a = 5.541(2)$, $c = 7.020(3)$ Å, $V = 186.6$ Å³, $Z = 1$, $D_{\text{obs}} = 3.986$ g/cm³, $D_{\text{calc}} = 4.000$ g/cm³, $\mu = 9.995$ mm⁻¹. Starting parameters for the refinement were taken from those of oligite (Sokolova et al. 1990; *Vestnik MGU Ser.4, Geologiya*, 1, 87–91). The strongest lines of the powder X-ray diffraction pattern (diffractometer, CoK α , 25 lines) are 7.044(22,001), 3.964(60,101,011), 2.839(100,012), 2.774(100,110), 2.344(20,003), 2.272(19,021), 1.984(40,202), 1.611(26,212,122), 1.387(19,220). The mineral is isostructural with oligite.

Bari-oligite was discovered in the Palitra (Palette) pegmatite in the underground workings of Mt. Kedykverpakhk in the north-western part of the Lovozero alkaline massif, Kola Peninsula, Russia. It occurs in “nests,” intimately associated with manaksite, natrosilite, and villiaumite. Other associated minerals include aegirine, analcime, chkalovite, natrolite, serandite, sodalite, ussingite, and vuonnemite. The paragenesis in which bari-oligite is found is anhydrous; bari-oligite is thought to have formed as a late-stage crystallization product of a “dry” melt supersaturated in Na + F at temperatures of 300–350 °C. The mineral is the Ba end member in a solid solution with oligite (Sr), for which it is named. The type material has been deposited at the A.E. Fersman Mineralogical Museum, Russian Academy of Science, Moscow, Russia (catalogue no. 2908/1). **P.C.P./T.S.E.**

HÄLENIUSITE-(LA)*

Holstam, D., Grins, J., Nysten, P. (2004) Häleniusite-(La) from the Bastnäs deposit, Västmanland, Sweden: A new REE oxy-fluoride mineral species. *Can. Mineral.* 42(4), 1097–1103.

Häleniusite-(La) occurs as yellow, powdery, massive layers replacing bastnäsite-(La) and ferriallanite-(Ce). Individual crystallites are less than one micrometer across; standard physical and optical properties could not be measured. It is non-fluorescent under short-wave UV radiation. Electron microprobe analysis (WDS) gave La₂O₃ 39.29, Ce₂O₃ 39.00, Pr₂O₃ 4.06, Nd₂O₃ 7.60, Sm₂O₃ 0.28, Gd₂O₃ 0.27, Y₂O₃ 0.08, SiO₂ 0.38, CaO 0.02, F 11.70, O = F – 4.93, sum 97.75 wt%, corresponding to (La_{0.431}Ce_{0.425}Nd_{0.082}Pr_{0.044}Si_{0.011}Sm_{0.003}Gd_{0.003}Y_{0.001}Ca_{0.001}F_{1.10}O_{0.95}). Analyses from energy dispersive X-ray spectrometry gave similar results but indicate O > F and are thought to be more

accurate than the WDS results, based on similar results for bastnäsite analyzed under the same conditions. A proposed general formula for the natural mineral is La_(1-y)[Ce³⁺_(y-x)Ce⁴⁺_x]O_(1+x)F_(1-x). The density could not be determined but was calculated to be 6.5 g/cm³. The mineral is expected to be isotropic, $n_{\text{calc}} \approx 1.9$. A single crystal structure determination was not possible and therefore the Rietveld method was employed. The strongest lines on the X-ray diffraction pattern [Guinier-Hägg camera, (40.16 mm, *d*-spacings), diffractometer (intensities), CuK α , 17 lines given] are 3.252(100,111), 2.815(31,200), 1.991(61,220), 1.6969(46,311), 1.2916(331), 1.1486(12,422). A Rietveld refinement of the powder X-ray diffraction data was performed ($R_F = 0.051$, $\chi^2 = 0.86$, 12 refined parameters). Results indicate häleniusite-(La) to be cubic, $Fm\bar{3}m$, $a = 5.6282(5)$ Å, $V = 178.28(5)$ Å³, and $Z = 4$. The mineral is isostructural with fluorite.

Häleniusite-(La) was found on the dumps of the Bastnäs Cu-REE mines in Västmanland, Sweden. It is associated with bastnäsite-(Ce), brochanite, ferriallanite-(Ce), and quartz. Additional minerals in the dumps include cerite-(Ce), molybdenite, and an amphibole. The mineral is a secondary alteration product of bastnäsite-(La) via a decarbonation reaction. The name of the mineral is for Ulf Hälenius, Professor of Mineralogy, Swedish Museum of Natural History. The type material has been deposited at the Swedish Museum of Natural History, Stockholm, Sweden (catalogue no. 20030025).

Discussion. There are no structural refinements of REE oxy-fluorides in the literature. No evidence exists for the presence of Ce⁴⁺ except for an argument based on the O \leftrightarrow F substitution. A single-crystal structure refinement of the mineral is required before a complete correct general formula can be proposed. **P.C.P.**

LEPKHENELMITE-Zn*

Pekov, I.V., Chukanov, N.V., Shilov, G.V., Kononkova, N.N., Zadov, A.E. (2004) Lepkhenelmit-Zn, Ba₂Zn(Ti,Nb)₄[Si₄O₁₂]₂(O,OH)₄·7H₂O, a new mineral of the labuntsovite group, and its crystal structure. *Zapiski Vseross. Mineral. Obshch.* 133(1), 49–58 (in Russian, English abstract).

Lepkhenelmit-Zn from Mt. Lepkhe-Nel'm, Lovozero massif, Russia, occurs as flat, prismatic crystals, elongated along [010], up to 2.5 × 0.5 mm in size. Crystals are often in sheaf-like aggregates. Individual crystals are striated along their length and the main forms are {100} and {001} pinacoids. Lepkhenelmit-Zn is transparent, light brown and has a white streak. It is vitreous, brittle, has no discernible cleavage, an uneven fracture and a Mohs hardness of ~5. Electron microprobe analyses of the holotype material gave Na₂O 0.59, K₂O 1.98, CaO 1.16, SrO 1.79, BaO 11.04, MgO 0.02, MnO 0.81, FeO 0.21, ZnO 3.66, Al₂O₃ 0.42, SiO₂ 37.01, TiO₂ 18.56, Nb₂O₅ 10.60, H₂O 11.80, sum 99.65 wt%, corresponding to (Ba_{0.92}K_{0.54}Ca_{0.26}Na_{0.24}Sr_{0.22})_{Σ2.18}(Zn_{0.58}Mn_{0.15}Fe_{0.04}Mg_{0.01})_{Σ0.78}(Ti_{2.97}Nb_{1.02})_{Σ3.99}(Si_{7.89}Al_{0.11})_{Σ8.00}O₂₄[O_{2.01}(OH)_{1.99}]_{Σ4.00}·7.39H₂O (H₂O determined by weight loss during heating of a 2.04 mg sample). The simplified formula is Ba₂Zn(Ti,Nb)₄[Si₄O₁₂]₂(O,OH)₄·7H₂O based on (Si,Al)₈O₂₄(O,OH)₈. The IR spectrum of lepkhenelmit-Zn is similar to others of the labuntsovite group and includes absorption bands at 3580, 1638, 1605, 1076, 1020, 940, 771, 690 (Ti-O

stretching), 587, 505, 463 and 420 cm^{-1} . Lepkhenelmitite-Zn is biaxial positive, $\alpha = 1.683(2)$, $\beta = 1.692(2)$, $\gamma = 1.795(4)$, $2V_{\text{obs}} = 30(10)^\circ$, $2V_{\text{calc}} = 34.5^\circ$. It shows weak pleochroism, is colourless on *X* and *Z*, pale yellowish-brown on *Y* ($Y = b$). There is no dispersion and anomalous extinction was observed on sections perpendicular to the optic axis.

The crystal structure of lepkhenelmitite-Zn was refined by single-crystal X-ray diffraction methods, $R_1 = 0.099$ for 1040 reflections with $I > 2\sigma(I)$. Starting parameters were taken from kuzmenkoite [Rastsvetayeva et al. 2000; *Kristallogr.* 45(5), 830–832]. The mineral is monoclinic, *Cm*, $a = 14.381(3)$, $b = 13.889(3)$, $c = 7.793(2)$ Å, $\beta = 117.52(3)^\circ$, $V = 1380.4(5)$ Å³, $Z = 2$, $D_{\text{calc}} = 3.07$ g/cm³, $\mu = 29.82$ mm⁻¹. The strongest lines on the powder X-ray diffraction pattern (CoK α radiation, 42 lines) are 6.95(37,020,001), 6.39(10,20 $\bar{1}$,200), 3.194(100,42 $\bar{1}$, 40 $\bar{2}$, 400), 3.101(041,022), 3.050(8,24 $\bar{1}$,240). Lepkhenelmitite-Zn is the Ba-Zn-Ti member of the kuzmenkoite subgroup, labuntsovite group, and forms a continuous solid-solution series with kuzmenkoite-Zn. The crystal structure of lepkhenelmitite-Zn is isostructural with other monoclinic members of the labuntsovite group and consists of a mixed framework of bent chains of edge-sharing M (Ti,Nb) octahedra elongated along [100] and connected by four-membered rings of SiO₄ tetrahedra. Zn is located in a partially filled site (60%) between chains of (Ti,Nb) octahedra. Ba and H₂O are disordered within cavities.

Lepkhenelmitite-Zn was discovered in pegmatite no. 45 on the north slope of Mt. Lepkhe-Nel'm, Lovozero massif, Russia. The mineral occurs in small cavities along with lamprophyllite, eudialyte, tsepinite-Na, kuzmenkoite-Zn, and paratsepinite-Ba, increasing in modal abundance toward corroded lamprophyllite. It is the result of late-stage crystallization from oxidized hydrothermal fluids enriched in Ba and Zn. The mineral is named after the locality, Mt. Lepkhe-Nel'm and for its dominance in Zn. The type material has been deposited at the A.E. Fersman Mineralogical Museum, Russian Academy of Science, Moscow, Russia (catalogue no. 2709/1). **P.C.P./T.S.E.**

PHOSPHOWALPURGITE*

Sejkora, J., Čejka, J., Hloušek, J., Novák, M., Šrein, V. (2004) Phosphowalpurkite, the (PO₄)-dominant analogue of walpurkite from Smrkovec, Slavkovsky Les Mountains, Czech Republic. *Can. Mineral.* 42(4), 963–972.

The mineral occurs as small clusters of irregular crystals up to 1 cm² within small fissures and cavities. Euhedral, tabular crystals do not exceed 1 mm in size (average 0.1–0.3 mm). The dominant form on these euhedral crystals is {010}. Phosphowalpurkite is brownish grey, translucent, with a light brownish grey streak. It is vitreous to adamantine, has an uneven to conchoidal fracture, and is not fluorescent under both long- and short-wave UV radiation. It is brittle, with perfect {010} cleavage, and has a Mohs hardness < 5. Electron microprobe analyses gave CaO 0.34, CuO 0.30, PbO 0.24, Fe₂O₃ 0.40, Bi₂O₃ 65.39, SiO₂ 0.18, P₂O₅ 7.65, V₂O₅ 0.12, As₂O₅ 4.15, UO₃ 18.73, H₂O 2.59, sum 100.09 wt%, corresponding to an empirical formula, based on 16 oxygen atoms pfu, of [(UO₂)_{0.91}Ca_{0.08}Fe_{0.07}Cu_{0.05}Pb_{0.01}]_{Σ1.12}Bi_{3.91}O_{3.91}[(PO₄)_{1.50}(AsO₄)_{0.50}(SiO₄)_{0.04}(VO₄)_{0.02}]_{Σ2.06}·2.00H₂O. The simplified formula is (UO₂)Bi₄O₄(PO₄)₂·2H₂O. The density

could not be determined but has been calculated to be 6.36 g/cm³. Phosphowalpurkite is biaxial, with indices of refraction between 1.9 and 2.0. No other optical data are given. The IR spectrum contains absorption bands at 429–476 cm^{-1} [split ν_2 (PO₄)³⁻ and ν_4 (AsO₄)³⁻ bending], 778–779 cm^{-1} [symmetric stretching ν_1 (AsO₄)³⁻], 796–871 cm^{-1} [antisymmetric stretching ν_3 (AsO₄)³⁻], 885 cm^{-1} [antisymmetric stretching ν_3 (UO₂)²⁺], 830 cm^{-1} [symmetric stretching ν_1 (UO₂)²⁺], 943 cm^{-1} [symmetric stretching ν_1 (PO₄)³⁻], 964–1152 cm^{-1} [antisymmetric stretching ν_3 (PO₄)³⁻], 1604–1634 cm^{-1} (δ H₂O bending vibrations), and 2862–3520 cm^{-1} (OH-stretching vibrations of H₂O molecules). A single-crystal study of phosphowalpurkite was not feasible due to the multiple subparallel intergrowths of the crystals. Triclinic symmetry (*P* $\bar{1}$), $Z = 1$ was assumed, with $a = 7.060(3)$, $b = 10.238(4)$, $c = 5.464(3)$ Å, $\alpha = 101.22(4)$, $\beta = 109.93(3)$, $\gamma = 87.93(4)^\circ$, $V = 364.0(3)$ Å³, $a:b:c = 0.6896:1:0.5337$. The strongest lines on the diffraction pattern (CoK α , diffractometer, 43 lines) are 10.059(100,010), 5.630(28,1 $\bar{1}$ 0), 5.467(18,110), 5.014(21,020), 4.902(28,10 $\bar{1}$), 3.952(28,02 $\bar{1}$), 3.346 (43,030), 3.266(31,21 $\bar{1}$), 3.251(72,021), 3.125(86,210), 3.084(95,1 $\bar{2}$ 1), 3.005(52,13 $\bar{1}$), 2.726(42,220), 2.370(25,1 $\bar{4}$ 0), 2.175(21,3 $\bar{1}$ 0), 1.9047(22,150), 1.8582(20,231).

Phosphowalpurkite occurs in fissures and cavities in a quartz gangue of a small Ag/Bi/U ore deposit near Smrkovec, 10 km NNE of Mariánské Lázně, Slavkovsky Les Mountains, western Bohemia, Czech Republic. Hydrothermal veins containing the ore are located in a fault zone between a granitic body and surrounding metamorphic rocks. Primary minerals include bismuth, Ag-bearing sulfides, Ni-Co arsenides, sillénite, and uraninite. Secondary minerals associated with phosphowalpurkite include altesite-group minerals, autunite, Bi-Mn oxides, bismutite, bismutoferrite, eulyite, metatorbernite, mixite, preisingerite-group minerals, pucherite, walpurkite, and zippeite. Phosphowalpurkite is the P-analogue of walpurkite, from which the new mineral name has been derived. Type material is deposited under Plp 10/2001 at the Department of Mineralogy and Petrology, National Museum, Prague, Czech Republic. **P.C.P.**

RUDENKOITE*

Chukanov, N.V., Dubinchuk, V.T., Murashko, M.N., Zadov, A.E., Karpenko, V.Yu. (2004) Rudenkoite, Sr₃Al_{3.5}Si_{3.5}O₁₀(OH_{7.5}O_{0.5})Cl₂·H₂O, a new mineral from phlogopite deposits of southern Yakutsk. *Zapiski Vseross. Mineral. Obshch.* 133(3), 37–41 (in Russian, English abstract).

Rudenkoite occurs as white, spheroidal aggregates up to 7 mm in diameter, consisting of radiating [100], flexible fibers. The Mohs hardness of the aggregates is 1.5. Electron microprobe analyses (average of 3) gave CaO 0.86, SrO 34.61, BaO 0.54, Al₂O₃ 21.01, SiO₂ 24.73, Cl 9.06, H₂O_{calc} 10.10, O = Cl – 2.04, sum 98.89 wt%, corresponding to (Sr_{2.83}Ba_{0.33}Ca_{0.13})_{Σ6.97}(Al_{3.49}Si_{3.48})_{Σ6.97}O_{10.16}(OH)_{7.88}Cl_{2.16}·0.8H₂O, based on 21 (O + Cl). The general formula is Sr₃Al_{3.5}Si_{3.5}O₁₀(OH_{7.5}O_{0.5})Cl₂·H₂O. Based on anion stoichiometry of other aluminosilicates, the general formula of rudenkoite could be Sr₃Al₃[(Si,Al)₄O₁₀](OH,OH)₈Cl₂·H₂O. The IR spectrum contains the following absorption bands: 3639, 3420, 3403, 3294 (OH and H₂O), 1627, 1183, 1071, 1015, 980, 964, 874, 825, 790, 748, 735, 676, 646, 598, 555, 537, 488, 435, and 418 cm^{-1} . Thermal analysis of rudenkoite resulted in two stages of

mass losses: 280–460 °C, 1.7% loss (loss of H₂O), 460–560 °C, no change, 560–940 °C, 17.5% loss (dehydroxylation and removal of Cl). Rudenkoite is biaxial positive, $\alpha = 1.639(2)$, $\beta = 1.648(2)$, $\gamma = 1.665(2)$ $2V_{\text{obs}} = 75(10)^\circ$, $2V_{\text{calc}} = 72.71^\circ$. The dispersion is average, $r > v$, $X = a$, and pleochroism as not observed. The unit-cell parameters were determined by electron microdiffraction techniques and gave $a \sim 5.89$, $b \sim 7.28$, $c \sim 10.33$ Å, $\beta \sim 97.2^\circ$, $V \sim 440$ Å³. Rudenkoite is monoclinic, with space group $P2/m$, $P2$, or Pm . The unit-cell parameters were further refined using the powder X-ray diffraction pattern (Debye-Scherrer, $\text{FeK}\alpha$, 40 lines) and gave $a = 5.893(5)$, $b = 7.262(5)$, $c = 10.288(8)$ Å, $\beta = 97.23(3)^\circ$, $V = 436.8(6)$ Å³. The strongest lines in the pattern are 10.13(100,001), 7.23(30,010), 5.23($\bar{1}01$), 3.23(80,112), 3.12(30, $\bar{1}03$), 2.96(100,022), 2.90(100,121), 2.79(40,103), 2.70(30, $\bar{2}12$), 2.419(30,030), 2.363(20, $\bar{1}23$), 2.313(30, $\bar{1}14$), 2.258(20, $\bar{2}13$), 2.182(80,032,221), 2.104(60,203), 1.988(50,223), 1.936(20, $\bar{1}15$), 1.902(20, $\bar{3}02$), 1.855(70,105), 1.819(30,040), 1.689(40, $\bar{1}06$), 1.652(20,125, $\bar{3}04$), 1.617(60,224), 1.595(60, $\bar{2}25$), 1.456(60, $\bar{1}07,007$), 1.394(30,411), 1.378(20, $\bar{2}07$), 1.276(40,008), 1.255(50,018), 1.240(30,046), 1.219(30, $\bar{4}33,108$), 1.201(20,061), 1.145(40,501), 1.103(30,307), 1.092(20,521).

Rudenkoite was discovered in the Emel'dzhaksky phlogopite deposit, Aldan province, Aldan Shield, southern Yakutsk, Russia. The Emel'dzhaksky deposit has a metasomatic origin, the result of garnet-wollastonite skarn formation at the contact between a pegmatite and a calcite marble. The last stages of metasomatism were accompanied by extensive prehnitization. Rudenkoite is a product of this prehnitization and was found in a pseudomorph of prehnite after scapolite. It is associated with calcite, diopside and fluorapatite. The mineral was named for Professor Sergey Alexandrovich Rudenko (1917–1992) of the St. Petersburg (Leningrad) Mining Institute. Type material is deposited at the Fersman Mineralogical Museum, Russian Academy of Science, Moscow, Russia (catalogue no. 3121/1). **P.C.P./T.S.E.**

NEW DATA

BOOTHITE*

Leverett, P. McKinnon, A.R., Williams, P.A. (2004) New data for boothite, $\text{CuSO}_4 \cdot 7\text{H}_2\text{O}$, from Burruga, New South Wales. *Aus. J. Mineral.* 10(1), 3–6.

Chemical analysis and powder X-ray diffraction data have been presented for boothite for the first time. Atomic absorption analysis of the mineral gave Cu 21.49, Zn 1.41, Mg 0.69, Mn 0.22, Co 0.06, Fe < 0.01% corresponding to $(\text{Cu}_{0.860}\text{Mg}_{0.072}\text{Zn}_{0.05}\text{Mn}_{0.010}\text{Co}_{0.003})_{\Sigma 1.000}\text{SO}_4 \cdot 7\text{H}_2\text{O}$ on the basis of one cation pfu. Boothite is monoclinic, $P2_1/c$, $a = 14.190(10)$, $b = 6.537(2)$, $c = 10.825(6)$ Å, $\alpha = 106.02(5)^\circ$. The strongest lines on the powder X-ray diffraction pattern (diffractometer, $\text{CuK}\alpha$, 23 lines) are 5.358(22,011), 5.378(13, $\bar{1}02$), 4.890(100,111), 4.826(43, $\bar{2}02$), 2.798(33, $\bar{3}11$), 3.269(20,020), 2.730(11,411). Refined cell parameters are consistent with those for other members of the melanterite group. Boothite is an ephemeral mineral and virtually impossible to preserve in an artificial environment. Boothite at Burruga was formed during post-mining mineralization at the base of a dump during a prolonged period of dry weather (>40 °C).

CALCIUM CATAPLEIITE*

Merlino, S., Pasero, M., Bellezza, M., Pushcharovsky, D.Yu., Gobetchia, E.R., Zubkova, N.V., Pekov, I.V. (2004) The crystal structure of calcium catapleite. *Can. Mineral.* 42(4), 1037–1045.

The crystal structure of holotype calcium catapleite (Burpala massif, northern Baikal region, Siberia, Russia), has been solved and refined by single-crystal X-ray diffraction methods using a $0.2 \times 0.1 \times 0.1$ mm³ crystal, $R_1 = 0.0528$ ($wR^2 = 0.1604$) for 2167 reflections with $I > 6\sigma(I)$. The mineral is orthorhombic, $Pbnn$, $a = 7.378(1)$, $b = 12.779(1)$, $c = 10.096(1)$ Å, $V = 951.89$ Å³, $Z = 4$, $D_{\text{calc}} = 2.746$ g/cm³, $\mu = 2.12$ mm⁻¹. The framework topology of calcium catapleite corresponds to that of catapleite; in calcium catapleite, the Ca atoms are ordered on two distinct sites with site occupancies of 0.8 and 0.2, respectively, whereas the Na atoms in catapleite are fully disordered. **P.C.P.**

GIUSEPPEITTE*

Bonaccorsi, E. (2004) The crystal structure of giuseppettite, the 16-layer member of the cancrinite-sodalite group. *Microporous Mesoporous Mat.* 73, 129–136.

The crystal structure of giuseppettite has been solved and refined on a $0.3 \times 0.2 \times 0.2$ mm³ single crystal, twinned on (001), using single-crystal synchrotron diffraction methods at the Elettra synchrotron facility (Trieste, Italy, $\lambda = 0.99890$ Å), $R_1 = 0.074$ for 3706 reflections with $I > 4\sigma(I)$. The mineral is hexagonal, $P31c$, $a = 12.856(2)$, $c = 42.256(8)$ Å, $Z = 1$, $D_{\text{calc}} = 2.32$ g/cm³, refined twin fraction 0.501(6). A new general formula for giuseppettite is proposed based on single-crystal synchrotron diffraction results and can be written $[\text{Na}_{42}\text{K}_{16}\text{Ca}_6]_{\Sigma 64}\text{Si}_{48}\text{Al}_{48}\text{O}_{192}(\text{SO}_4)_{10}\text{C}_{12} \cdot 5\text{H}_2\text{O}$. Giuseppettite is the 16-layer member of the cancrinite-sodalite group. Its structure consists of two cages along [00z] as well as CCSCCS sequences of “cancrinite” (C) and “sodalite” (S) cages. Within the giuseppettite cages are located sulfate groups surrounded by alternating Na and K cations whereas a partially disordered distribution of sulfate groups and Cl anions occur within the S cages; Na and H₂O occur in the C cages. **P.C.P.**

KASSITE*

Pekov, I.V., Schneider, J., Pushcharovsky, D.Yu. (2004) X-ray powder diffractogram of kassite and its relationship to cafetite. *Zapiski Vseross. Mineral. Obshch.* 133(3), 51–55 (in Russian, English abstract).

The powder X-ray diffraction pattern of kassite, $\text{Ca}_2\text{Ti}_2\text{O}_4(\text{OH})_2$, from the Saranovsky chromite deposit (Urals), has been published for the first time. Electron microprobe analysis of the material gave CaO 22.94, MgO 0.52, MnO 0.08, Al₂O₃ 0.50, V₂O₃ 0.25, Cr₂O₃ 2.24, Fe₂O₃ 0.37, TiO₂ 64.18, H₂O_{calc} 8.92, sum 100.00 wt%, corresponding to $\text{Ca}_{0.97}(\text{Ti}_{1.91}\text{Cr}_{0.07}\text{Mg}_{0.03}\text{Al}_{0.02}\text{Fe}_{0.01}\text{V}_{0.01}\Sigma 2.05)\text{O}_{3.97}(\text{OH})_{2.03} \cdot 0.16\text{H}_2\text{O}$ (H₂O content calculated by difference). The strongest lines on the powder X-ray diffraction pattern (diffractometer, $\text{MoK}\alpha$, 71 lines) are 4.763(26,002), 3.300(100,11 $\bar{2}$,1112), 3.273(97,022), 2.603(23,130), 2.316(19,20 $\bar{2}$), 2.282(37,132), 1.776(18,20 $\bar{4}$), 1.762(41,134,204), 1.516(24,330). The mineral is monoclinic,

$P2_1/a$, with unit-cell parameters, refined from the powder-diffraction pattern, of $a = 5.273(4)$, $b = 8.990(8)$, $c = 9.546(8)$ Å, $\beta = 90.47(8)^\circ$, $V = 452.5(1)$ Å³. Kassite and cafetite are polymorphs. **P.C.P./T.S.E.**

JENNITE*

Bonaccorsi, E., Merlino, S., Taylor, H.F.W. (2004) The crystal structure of jennite, $\text{Ca}_9\text{Si}_6\text{O}_{18}(\text{OH})_6 \cdot 8\text{H}_2\text{O}$. *Cement Concrete Res.* 34, 1481–1488.

The crystal structure of jennite has been solved and refined using single-crystal synchrotron diffraction methods at the Elettra synchrotron facility (Trieste, Italy, $\lambda = 0.99890$ Å), $R_1 = 0.153$ for 1278 reflections with $I > 4\sigma(I)$. The mineral is triclinic, $P\bar{1}$, $a = 10.576(2)$, $b = 7.265(2)$, $c = 10.931(3)$ Å, $\alpha = 101.30(1)$, $\beta = 96.98(1)$, $\gamma = 109.65(1)^\circ$, $Z = 1$, $D_{\text{calc}} = 2.325$ g/cm³, $\mu = 1.912$ mm⁻¹. The crystal structure of jennite is strongly disordered, built up of ribbons of edge-sharing CaO_6 octahedra, chains of SiO_4 tetrahedra parallel to b , and CaO_6 octahedra on the inversion centres. Results from the structure refinement indicate the revised chemical formula of jennite to be $\text{Ca}_9\text{Si}_6\text{O}_{18}(\text{OH})_6 \cdot 8\text{H}_2\text{O}$. Jennite transforms to “metajennite” between 70 and 90°C by dehydration of four water molecules from around a Ca atom, resulting in a shrinking of the unit cell in the c direction. A model for the crystal structure of “metajennite” is proposed.

Discussion. Although the name “metajennite” is used in the manuscript to describe the dehydration product of jennite, it has not been approved by the IMA CNMMN. **P.C.P.**

MAHNERTITE*

Pushcharovsky, D.Y., Zubkova, N., Teat, S.J., Maclean, E.J., Sarp, H. (2004) Crystal structure of mahnertite, *Eur. J. Mineral.* 16, 687–692.

The crystal structure of the sodium copper arsenate mineral, mahnertite has been solved and refined on a $20 \times 20 \times 2$ μm single crystal at the Synchrotron Radiation Source, Daresbury Laboratory, U.K. ($\lambda = 0.6898$ Å), $F(000) = 2150$, $R_1 = 0.049$ for 639 reflections with $I > 2\sigma(I)$. Mahnertite is tetragonal, space group $I4/mmm$, with $a = 10.0371(1)$, $c = 23.739(1)$ Å, $V = 2391.5(4)$ Å³, $Z = 8$, $D_{\text{calc}} = 3.32$ g/cm³, $D_{\text{obs}} = 3.14$ g/cm³, $\mu = 9.78$ mm⁻¹. The chemical formula, on the basis of site assignments, is $(\text{Na}_{0.88}\text{Ca}_{0.12})\text{Cu}_{2.75}(\text{AsO}_4)_2\text{Cl}_{0.62} \cdot 3.63\text{H}_2\text{O}$. The general formula can be written as $(\text{Na,Ca})\text{Cu}_3[\text{AsO}_4]_2\text{Cl} \cdot 5\text{H}_2\text{O}$.

The crystal structure of mahnertite is dominated by mixed polyhedral sheets parallel to (001) comprised of two symmetrically independent distorted $\text{Cu}\phi_5$ square pyramids (where ϕ is an unspecified ligand) and AsO_4 tetrahedra, identical to those found in zdenekite, $\text{NaPbCu}_3(\text{AsO}_4)_4\text{Cl} \cdot 5\text{H}_2\text{O}$. The mixed polyhedral sheets in both mahnertite and zdenekite are related by different modes of stacking; other polytypes may occur in chemically related mineral species. **P.C.P.**

NOBLEITE

Karanović, L., Rosić, A., Poleti, D. (2004) Crystal structure of nobleite, $\text{Ca}[\text{B}_6\text{O}_9(\text{OH})_2] \cdot 3\text{H}_2\text{O}$, from Jarandol (Serbia). *Eur. J. Mineral.* 16, 825–833.

The crystal structure of a single crystal ($0.34 \times 0.16 \times 0.04$ mm) of nobleite from the Jarandol basin, central Serbia, has been determined by single-crystal X-ray diffraction methods, $R_1 = 0.03245$ for 2432 reflections with $I > 2\sigma(I)$. Nobleite is monoclinic, $P2_1/a$, $a = 14.580(1)$, $b = 8.0240(7)$, $c = 9.8486(8)$ Å, $\beta = 111.801(2)^\circ$, $V = 1069.7(2)$ Å³, $D_{\text{obs}} = 2.092$ g/cm³, $Z = 4$, $\mu = 0.669$ mm⁻¹. Wet chemical analyses of a mixture of ulexite and nobleite gave (nobleite values in brackets) Na_2O 5.57, K_2O 0.11, CaO 14.43(4.15), MgO 0.03(0.03), SrO 0.10(0.10), B_2O_3 47.51(15.61), H_2O 32.11(5.71), sum 99.86 wt%, corresponding to $\text{Ca}_{0.97}\text{Mg}_{0.01}\text{Sr}_{0.01}\text{B}_{5.89}\text{O}_9(\text{OH})_2 \cdot 3\text{H}_2\text{O}$. Nobleite is the Ca analogue of tunnelite, both of which are phyllo-hexaborates and members of the nobleite group represented by the symbol 6.FC.05.6(3Δ+3T), indicating that the fundamental building blocks of the structure are composed of six boron polyhedra, three of which are three-coordinated and three of which are four-coordinated. The structures of nobleite and tunnelite are similar but vary in the coordination of the M^{2+} cation (where $M = {}^{10}\text{Ca}$ in nobleite and ${}^{10}\text{Sr}$ in tunnelite) as well as the connectivity of the infinite sheets (in nobleite, the sheets are connected solely by hydrogen bonds).

Discussion. The authors note that ulexite and nobleite are intimately intergrown in all samples and therefore wet chemical analyses was the chosen method. However, no mention is made of how these two minerals were separated for the single-crystal X-ray diffraction study.

OKANOGANITE-(Y)*

Boiocchi, M., Callegari, A., Ottolini, L. and Maras, A. (2004) The chemistry and crystal structure of okanoganite-(Y) and comparison with vicanite-(Ce). *Am. Mineral.* 89(10), 1540–1545.

The crystal structure of the nesoborosilicate mineral okanoganite-(Y) has been determined by single-crystal X-ray diffraction methods, $R_1 = 0.0323$ for 1857 reflections with $I > 3\sigma(I)$. Okanoganite-(Y) is trigonal, $R3m$, $a = 10.7108(5)$, $c = 27.0398(11)$ Å, $D_{\text{calc}} = 4.96$ g/cm³, $Z = 3$. Analysis by a combination of EMPA and SIMS gave CaO 5.50, SrO 0.08, BaO 0.08, Y_2O_3 18.94, La_2O_3 7.60, Ce_2O_3 14.37, Pr_2O_3 1.88, Nd_2O_3 7.52, Sm_2O_3 2.07, Eu_2O_3 0.01, Gd_2O_3 2.69, Tb_2O_3 0.48, Dy_2O_3 3.23, Er_2O_3 1.88, Tm_2O_3 0.20, Yb_2O_3 0.87, PbO_2 0.01, UO_2 0.08, ThO_2 1.87, Na_2O 1.87, Fe_2O_3 2.18, TiO_2 0.56, SiO_2 14.94, Li_2O 0.02, $\text{BeO} < 0.01$, B_2O_3 3.80, P_2O_5 0.83, H_2O 1.33, F 2.98, sum 98.99 wt% [corresponding to $\text{Y}_{4.52}\text{REE}_{6.82}\text{Ca}_{2.65}\text{Na}_{1.63}\text{Th}_{0.19}\text{Sr}_{0.02}\text{Ba}_{0.01}\text{U}_{0.01}\text{O}_{215.85}(\text{Fe}_{0.74}^{3+}\text{Ti}_{0.19}\text{Li}_{0.04})_{20.97}(\text{Si}_{6.71}\text{B}_{2.94}\text{P}_{0.32}\text{Be}_{0.01})_{29.98}(\text{O}_{34.02}\text{OH}_{3.98})_{\Sigma 38.00}\text{F}_{10.04}$, calculated based on 38 anions). The formula as determined by site refinement is in accord with EMPA results [645.6(4) electrons pfu vs. 675.5]. The crystal structure of okanoganite-(Y) resembles that of vicanite-(Ce) (Ballirano et al. 2002; *Am. Mineral.*, 1139–1143), and together represent the only two borosilicate with a main structural unit of threefold rings of BO_4 tetrahedra.

Discussion. Tb_2O_3 and Tm_2O_3 were not included in the SIMS analysis and have therefore been estimated by interpolation on the C1-chondrite normalized REE pattern. There are significant differences between the chemical analyses reported in this manu-

script and in the original description of okanoganite-(Y) by Boggs (1980; *Am. Mineral*, 65: 1138–1142) including a lower B content (3.0 vs. 2.4 pfu B), absence of P and OH, a higher Na/Ca ratio (1.5 vs. 0.6), and a higher F content (16 vs. 10 pfu F). The authors suggest that these discrepancies are due to analytical error but, with the exception of the variable B content (analytical error) and presence of P in the new data, no effort is made to explain these variations. **P.C.P.**

SHCHERBAKOVITE*

Krivovichev, S.V., Yakovenchuk, V.N., Pakhomovskiy, Ya.A. (2004) Topology and symmetry of the titanosilicate framework in the crystal structure of shcherbakovite, Na(K,Ba)₂(Ti,Nb)₂O₂[Si₄O₁₂]. *Zapiski Vseross. Mineral. Obshch.* 133(3), 55–63 (in Russian, English abstract).

The crystal structure of shcherbakovite from Mt. Eveslogchorr, Khibina massif, Kola Peninsula, Russia, has been determined by 0.30 × 0.22 × 0.12 mm crystal by single-crystal X-ray diffraction methods, $R_1 = 0.033$ for 1194 reflections with $I > 4\sigma(I)$. The mineral is orthorhombic, *Imma*, $a = 8.1511(4)$, $b = 10.5502(5)$, $c = 13.9784(7)$ Å. The structure of shcherbakovite is based on chains of TiO₆ octahedra linked via Si₄O₁₂ chains into a three-dimensional network. In this structure, the six-coordinated site occupied predominantly by Ti show strong positional disorder and has been split into M(1) and M(2), located 0.47

Å from each other. Both sites are strongly distorted, a feature characteristic of transition metals and of minerals containing ¹⁶Ti⁴⁺ in general. The polarity of the vectors resulting from the presence of short and long apical bonds in the TiO₆ octahedron leads to the possibility of a disordered (centrosymmetric) or ordered (non-centrosymmetric) structure as is observed in batisite, the Ba analogue of shcherbakovite. It is likely that the degree of order in the TiO₆ octahedra in the batisite-shcherbakovite series is a direct result of the conditions of formation and is typomorphic in nature. **P.C.P./T.S.E.**

DISCREDITATIONS

SPODIOSITE*

Holtstam, D. (2004) Spodiosite discredited. *GFF*, 126, 253–254.

The mineral “spodiosite” has been discredited. Two samples of “spodiosite,” originally described from the Nyttsta Krangruva mine, Filipstad, Sweden, was analyzed by powder X-ray diffraction methods, in back-scattered electron (BSE) mode on a SEM, and by energy-dispersive spectroscopy (EDS). The data indicate that “spodiosite” is heterogeneous mixture of fluorapatite, calcite, and serpentine. The unusual crystal shape likely represents a pseudomorph after a known precursor mineral. The discreditation has been approved by the IMA CNMMN. **P.C.P.**