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New Mineral Names*

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ARDENNITE-(V)*

A.A. Barresi, P. Orlandi, P. Pasero, M. Pasero (2007) History of ardennite and the new mineral ardennite-(V). Eur. J. Mineral., 19, 581–587.

Ardennite-(V) is from an outcrop in the locality of Sparone, Locana Valley (TO), Piedmont, Italy found in a specimen of piemontite-bearing mica schist. Ardennite-(V) occurs only in one thin quartzitic layer in the studied specimens and are associated with quartz, piemontite, and hematite; muscovite is abundant in the specimen, but not in direct contact with ardennite-(V). Other layers are very rich in piemontite or, alternatively, in golden-yellow muscovite and hematite, without any ardennite-(V). It occurs as acicular crystals, typically very thin, tabular and elongated along [010], which can reach 1 mm in length and a few microns in diameter.

Ardennite-(V) is orthorhombic, space group *Pnmm*, with $a = 8.760(3)$, $b = 5.838(2)$, $c = 18.56(2)$ Å. The five strongest peaks in the *X*-ray powder diffraction pattern [d(Å)(I)(hkl)] are: 2.948(90)(115), 2.609(100)(310/116), 2.033(55)(225), 1.585(75)(425), 1.477(45)(2.2.10).

Optically, ardennite-(V) is biaxial, with $\alpha > 1.765(5)$, $\beta < 1.775(5)$, and $\gamma = 1.775(5)$. Dispersion was not observed. Optical orientation: $Z = b$. Pleochroism is very weak, with X, Y = pale yellow; Z = yellowish. Crystals of ardennite-(V) are yellow, transparent with a white streak, and brittle. The luster is vitreous; fluorescence was not observed. The hardness has been estimated as 6−7 (Mohs). No cleavage or parting was observed. Density was not measured due to the very small dimensions of crystals but the calculated value is 3.55 g/cm^3.

Electron microprobe analyses (P_2O_5 0.38 wt%, As_2O_5 0.37, V_2O_5 4.60, SiO_2 31.21, TiO_2 0.21, Al_2O_3 22.60, Fe_2O_3 1.64, Cr_2O_3 0.34, MgO 4.44, MnO_{tot} 23.28, CaO 4.24, Na_2O 0.02, F 0.17, H_2O_{calc} 5.70), gave the following empirical formula: $[Mn^{2+}_{3.221}Ca_{0.774}Na_{0.006}]_{\Sigma = 4.001}[Al_{4.456}Mg_{1.127}Fe^{3+}_{0.210}Mn^{3+}_{0.137}Cr_{0.046}Ti_{0.027}]_{\Sigma = 6.003}[Si_{5.000}][V_{0.518}Si_{0.315}Al_{0.080}P_{0.055}As_{0.033}]_{\Sigma = 1.001}O_{21.433}(OH)_{6.475}F_{0.092}$.

The crystal structure of ardennite-(V) is isostructural with ardennite. The general formula of ardennite can be written as $A^{2+}_4(M^{3+}_5M^{2+})(T^{4+}_5T^{5+})O_{22}(OH)_6$. The crystal structure consists of chains of edge-sharing [MO_6] octahedra running along [010], linked together through [TO_4] and [T_3O_{10}] ortho- and tri-silicate groups, with A cations finding place within the larger structural voids. Since the A sites are invariably occupied by divalent cations, the charge balance is ruled by the coupled substitution $T^{4+} + M^{3+} \leftrightarrow T^{5+} + M^{2+}$. Typically T1, T2, and T3 sites are occupied by silicon and a pentavalent cation dominates at the T4 site. The distinction among different species of ardennite should be made on the basis of the dominant cation at the T4 site.

Type material is stored in the mineralogical collections of the Centro Interdipartimentale Museo di Storia Naturale e del Territorio, Università di Pisa, via Roma 103, 56011 Calci (PI), Italy (catalog no. 15525), and in the mineralogical collections of Museo Regionale di Scienze Naturali, via Giolitti 36, 10123 Torino, Italy (catalog M/U 15544). **K.T.**

GEORBARSANOVITE*

A.P. Khomyakov, G.N. Nechelyustov, I.A. Ekimenkova, R.K. Rastsvetayeva (2005) Georgbarsanovite, $Na_{12}(Mn,Sr,REE)_3Ca_6Fe^{2+}_3Zr_3NbSi_{25}O_{76}Cl_2 \cdot H_2O$, a mineral species ofthe eudialyte group: revalidation of barsanovite and the new name of the mineral. Zapiski Rossiyskogo Mineralogicheskogo Obshchestva, 134(6), 47–57 (in Russian, English abstract).

Georgbarsanovite (collected prior to 1963) came from boulders of nepheline-feldspar pegmatite in the upper reaches of the Petreliusa River valley, Khibiny alkaline massif, Kola Peninsula, Russia. It and niobian eudialyte replace earlier eudialyte associated with cancrinite, albite, aegirine-augite, alkali amphibole and biotite. Georgbarsanovite and eudialyte form irregular, multicolored aggregates to 8–10 cm, ranging from pink (earlier eudialyte) to reddish brown (niobian eudialyte) then yellow-green (georgbarsanovite). The georgbarsanovite consists of 1–2 cm thick branching veinlets in the reddish brown eudialyte, and shows both gradational and sharp contacts with this eudialyte. Georgbarsanovite is transparent to slightly translucent yellow-green with a vitreous luster and white streak. The mineral is brittle, does not have cleavage, uneven to conchoidal fracture, $H = 5$, $D_{obs} = 3.05(2)$, $D_{calc} = 3.11$ g/cm^3. Uniaxial (–) with anomalous biaxial character for some grains ($2V$ to 10–15°), $\omega = 1.639(2)$ (bottle green), $\varepsilon = 1.631(2)$ (pale yellow); non-fluorescent in UV light.

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* 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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The mineral decomposes and gelatinizes in heated acids.

Electron microprobe analysis and L.O.I. at 500 °C give the average composition Na_2O 11.03, K_2O 0.35, CaO 10.73, SrO 2.24, BaO 0.14, FeO 5.57, MnO 2.55, La_2O_3 0.87, Ce_2O_3 1.58, Nd_2O_3 0.65, Y_2O_3 0.43, ZrO_2 12.08, HfO_2 0.28, TiO_2 0.11, Nb_2O_5 3.72, SiO_2 46.03 Cl 1.20, F 0.35, H_2O 0.48, O = (F,Cl)–0.42, total 99.97 wt%. IR spectroscopy confirms the presence of (OH), H_2O and minor CO_2. On a basis of 53 total cations (Z = 3), the empirical formula is $(Na_{11.73}K_{0.24})_{\Sigma 11.97}(Mn_{1.19}Sr_{0.71}REE_{0.63}Ca_{0.30}Y_{0.13}Ba_{0.03})_{\Sigma 2.99}Ca_6(Fe^{2+}_{2.55}Zr_{0.23}Ti_{0.05}Hf_{0.04})_{\Sigma 2.87}Zr_3Nb_{0.92}Si_{25.25}O_{76.48}Cl_{1.11}F_{0.61}\cdot 0.88H_2O$, indicative of the ideal formula $Na_{12}(Mn,Sr,REE)_3Ca_6Fe^{2+}_3Zr_3NbSi_{25}O_{76}Cl_2\cdot H_2O$.

The strongest lines in the X-ray powder diffraction pattern (diffractometry) are [*d* Å, *I* % (*hkl*)]: 6.42, 54 (104); 4.304, 62 (205); 3.202, 100 (208); 3.176, 51 (306); 3.155, 71 (217); 3.017, 51 (119); 2.975, 98 (315); 2.857, 94 (404); 2.591, 54 (039). Refinement of the powder data gives a = 14.274(2), c = 30.02(1) Å, space group $R3m$. Single-crystal X-ray structure refinement (Ekimenkova et al. 2000, *Dokl. Ross. Akad. Nauk*, 370, 477-480) shows georgbarsanovite to be a new member of the eudialyte subgroup of the eudialyte group. It is an analog of ferrokentbrooksite with Mn dominant at $N(4)$ instead of Na. The mineral was originally named "barsanovite" by Dorfman et al. (1963, *Dokl. Akad. Nauk SSSR*, 153, 1164-1167), but was discredited in 1969 due to erroneous assignment of monoclinic symmetry. However, the mineral warrants new species status vis-à-vis the recent classification scheme for eudialyte-group minerals (Johnsen et al. 2003, *Can. Mineral.*, 41, 785-794). Because the name "barsanovite" was affiliated with a species defined as monoclinic, a new name had to be chosen for this trigonal mineral; consequently, it was resurrected as "georgbarsanovite." As with barsanovite, the name honors prominent Russian mineralogist Georgiy Pavlovich Barsanov (1907–1991). The type sample resides at the A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow (catalog no. 61504). **T.S.E.**

JADARITE*

C.J. Stanley, G.C. Jones, M.S. Rumsey, C. Blake, A.C. Roberts, J.A.R. Stirling, G.J.C. Carpenter, P.S. Whitfield, J.D. Grice, Y. Lepage (2007) Jadarite, $LiNaSiB_3O_7(OH)$, a new mineral species from the Jadar Basin, Serbia. Eur. J. Mineral., 19, 575–580.

Jadarite is a new lithium sodium borosilicate mineral which was discovered in drill core in the Jadar Basin, Serbia (44°32 'N, 19°18 'E) as massive white aggregates, several metres thick. The Jadar Basin is composed of a sequence of oil-shales, dolomicrites and pyroclastic deposits of Neogene (Early to Middle Miocene) age. Jadarite occurs as minute (5−10 μm) subhedral (tabular, elongate) to anhedral grains that were too small to analyze via single-crystal classical methods. It is associated with calcite, dolomite, K-feldspar, rutile, albite, ilmenite, pyrite, and fine-grained muscovite.

In transmitted light, plates and grains of jadarite show twinning in some crystallites and for λ 590 nm n_α = 1.536(±0.001) and n_γ = 1.563(±0.001). It is non-pleochroic, biaxial, and does not show parallel extinction. In plane-polarized reflected light, the mineral is dark grey with weak bireflectance, it is nonpleochroic and has abundant white internal reflections.

Jadarite was indexed on a primitive monoclinic unit cell of a = 6.818(2), b = 13.794(2), c = 6.756(2) Å, β = 111.10(2)° cell volume is 592.8(2) Å^3, Z = 4 and possible space group $P2_1/n$. The six strongest X-ray powder-diffraction lines [*d* in Å(*I*)(*hkl*)] are: 4.666 (62) (120, 021), 3.180 (82) (200), 3.152 (74) (002), 3.027 (40) (2 21), 2.946 (100) (131), 2.241 (74) (3 11,151). The measured density (Berman Balance) is 2.45 g/cm^3; calculated density is 2.46 g/cm^3 (on the basis of the empirical formula and unit-cell parameters refined from powder data). Jadarite shows weak pink-orange fluorescence under both short- and long-wave ultraviolet radiation.

Wet chemical analysis combined with CHN analyzer gave the following aggregate composition: Li_2O 7.3, Na_2O 15.0, SiO_2 26.4, B_2O_3 47.2, H_2O 4.3, total 100.2 wt%. The empirical formula, based on 3 B atoms per formula unit (apfu), is $Li_{1.08}Na_{1.07}Si_{0.97}B_3O_{6.99}(OH)_{1.06}$. The empirical formula based on 3 B atoms per formula unit (apfu), is $Li_{1.08}Na_{1.07}Si_{0.97}B_3O_{6.99}(OH)_{1.06}$.

Holotype material is deposited at the Natural History Museum, London, U.K., as BM 2006, 16. Parts of the holotype are housed within the Systematic Reference Series of the National Mineral Collection of Canada, Geological Survey of Canada, Ottawa, Canada under catalog number NMCC 068101, and cotype fragments have also been donated to the Natural History Museum, Budapest, Hungary and to the Belgrade Natural History Museum, Belgrade, Serbia. **K.T.**

LABYRINTHITE*

A.P. Khomyakov, G.N. Nechelyustov, R.K. Rastsvetaeva (2006) Labyrinthite $(Na,K,Sr)_{35}(Ca_{12}Fe_3Zr_6TiSi_{51}O_{144}(O,OH,H_2O)_9Cl_3$, a new mineral with a modular eudialyte-like structure from Khibiny alkaline massif, Kola Peninsula, Russia. Zap. Ross. Mineral. Obshch., 135(2), 38–49 (in Russian, English abstract).

Labyrinthite, a new member of the eudialyte group, was discovered in pegmatoid alkaline rocks intersected by drilling at Nyorkpakh Mt. in the Khibiny massif. The host rock mostly consists of K-feldspar, sodalite, alkali amphiboles, aegirine, pectolite, lamprophyllite, lomonosovite, villiaumite, and lovozerite-group minerals. Labyrinthite is scattered among these minerals as a late mineral, occurring as rounded grains from 0.5 to 1.0 cm in diameter; grain surfaces are partially replaced by aggregates of zirsinalite, lovozerite, and thermonatrite. Macroscopically labyrinthite looks very much like ordinary eudialyte: vivid pink color, white streak, glassy luster, brittle, and with a conchoidal fracture; D_{meas} = 2.88(2), D_{calc} = 2.87 g/cm^3. It is transparent pink and uniaxial (+) in thin section, ω = 1.597(1), ε = 1.601(1), and is fluorescent (bright violet) under N_2 laser. The mineral slowly decomposes in 10% solutions of HCl, NO_3, and H_2SO_4. The IR spectrum shows evidence of both OH and H_2O.

X-ray powder diffractometry (Cu*K*α radiation) gave space group $R3$, a = 14.239(1), c = 60.733(7) Å, Z = 3. The strongest maxima in the powder XRD pattern are [*d* Å, *I* % (*hkl*)]: 5.70, 34 (024); 4.324, 68 (02.10); 3.550, 39 (220); 3.230, 44 (02.16); 3.173, 34 (12.14); 3.049, 36 (11.18); 2.977, 100 (13.10); 2.853, 88 (048); 2.685, 38 (140); 2.605, 36 (03.18). Chemical composition by electron microprobe and the Penfield method is Na_2O

16.77, K_2O 1.11, CaO 10.73, SrO 1.24, FeO 2.56, MnO 1.00, Ce_2O_3 0.27, SiO_2 50.04, ZrO_2 11.90, TiO_2 0.67, Cl 1.70, F 0.11, H_2O 1.58, O = (Cl, F) –0.43, total 99.25 wt%, giving the empirical formula $(Na_{33.30}K_{1.45}Sr_{0.74})_{\Sigma 35.49}(Ca_{11.77}Ce_{0.10})_{\Sigma 11.87}(Fe_{2.19}Mn_{0.87})_{\Sigma 3.06}Zr_{5.94}(Ti_{0.52}Si_{0.26})_{\Sigma 0.78}Si_{51}O_{144.48}(OH)_{4.80}Cl_{2.95}F_{0.36}\cdot 3H_2O$ (basis of Si + Ti + Zr = 57.7 apfu), or ideally $(Na,K,Sr)_{35}Ca_{12}Fe_3Zr_6TiSi_{51}O_{144}(O,OH,H_2O)_9Cl_3$. The crystal structure of the mineral was solved previously by Rastsvetaeva and Khomyakov (2001, *Crystallogr. Reports*, 46, 752–757; abstracted in 2002, *Am. Mineral.*, 87, 767). The structure consists of alternating alluaivite-like and eudialyte-like layers, resulting in the doubled *c* period of ~ 60 Å. It is a member of the eudialyte group, and is the only member of its structural subgroup. The mineral name alludes to its very complex (labyrinthine) structure. Type material is deposited with the Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow (catalog no. 2624/2).

Discussion. "Labyrinthite" has introduced an unnecessary ambiguity into scientific terminology: the *exact* spelling of the mineral name in both French and Russian also corresponds to the viral or bacterial inflammation of the inner ear thought to be responsible for approximately 15% of all cases of vertigo (*labyrinthitis* in English). **T.S.E.**

PARAGEORGBOKIITE*

S.V. Krivovichev, S.K. Filatov, P.C. Burns, L.P. Vergasova (2007) The crystal structure of parageorgbokiite, β-$Cu_5O_2(SeO_3)_2Cl_2$. Can. Mineral., 45, 929–934.

Parageorgebokiite is found in fumaroles of the Great Fissure Talbachik eruption in the Kamchatka Peninsula, Russia. It occurs as 0.1 mm green transparent plates associated with copper selenite chlorides. Chemically the mineral is identical to georgebokiite, but the latter is dark brown to black, whereas parageorgebokiite is green with green pleochroism.

A crystal structure analysis gives the same chemical formula and space group as georgebokiite, but the cell dimensions are distinct. The structure determination was carried out using Mo$K\alpha$ radiation on a 0.06 × 0.04 × 0.02 mm crystal. The mineral is orthorhombic with a space group of $P2_1/c$ and cell dimensions of $a = 5.3982(5)$, $b = 8.0543(8)$, $c = 11.1277(10)$ Å, $\beta = 99.258(2)°$, $V = 477.52(8)$ Å^3 and $Z = 2$.

Copper is distributed between three unique octahedral sites coordinated with O^{2-} and Cl^-. Two of these sites are CuO_4Cl_2 and the third is CuO_5Cl. Selenium is found in a unique site where it is coordinated with three oxygens to form SeO_3 pyramids. In terms of Se and Cu oxygen bonds, the structure can be described as follows. Two O_1Cu_4 tetrahedra share an edge to form an O_2Cu_6 dimer. These dimers are further linked by sharing Cu corners to form an O_2Cu_5 chain parallel to *a*. The SeO_3 pyramids are attached to faces of the copper oxygen tetrahedra to form $([O_2Cu_5][SeO_3]_2)^{2+}$ chains. The chains form a three dimensional framework in which Cl^- fills the channels.

The structures of both georgebokiite and parageorgebokiite are built upon $([O_2Cu_5][SeO_3]_2)^{2+}$ but the structural channels in parageorgebokiite are larger than those in the georgebokiite structure. This feature and the lower density of parageorgebokiite lead the authors to suggest that parageorgebokiite is a high temperature form that is stabilized chemically or kinetically at ambient conditions. **G.P.**

PITTONGITE*

W.D. Birch, I.E. Grey, S.J. Mills, C. Bougerol, A. Pring, and S. Ansermet (2007) Pittongite, a new tungstate with a mixed-layer, pyrochlore—hexagonal tungsten bronze structure, from Victoria, Australia. Can. Mineral., 45, 857–864.

The new mineral pittongite was collected from mine dumps near the main shaft of a tungsten deposit 35 km west of Ballerat in the New England District of New South Wales. Geologically the area is characterized by quartz reefs on weathered Ordovician metasediments. The quartz reefs were emplaced hydrothermally during the intrusion of Devonian granitic pluton south of the deposit. Pittongite occurs as creamy-yellow aggregates replacing ferberite in massive quartz. The crystals form thin plates in aggregates up to 2 mm in width. The mineral is formed by direct alteration of ferberite in the presence of acidic, oxidizing solutions containing sodium. Associated minerals are bismuth, gold, bismuthinite and othe tungstates, and molybdates. The mineral name is for the former village of Pittong near the deposit. The type specimen is held at Museum Victoria (M48268).

The streak of pittongite is cream colored and the estimated hardness is 2–3. The luster is variable, from pearly to earthy. Exact density was not measured, but is greater than 4.4 g/cm^3. The calculated density is 5.715 g/cm^2. In thin pieces it is transparent. Limited optical data indicates the mineral is uniaxial negative with average refractive indices of 2.085 perpendicular to the platy dimension.

Quantitative analyses were carried out using WDS and a CHN analyzer for H_2O. Average of seven analyses gave the following (ranges in brackets): Na_2O 2.97(2.89– 3.03), K_2O 0.06 (0.03– 0.10), CaO 0.39(0.37–0.41) , Fe_2O_3 5.66 (5.39–5.83), Al_2O_3 0.51 (0.45–0.66), WO_3 84.15 (83.78–84.59), and H_2O 4.73 (4.68–4.77) with an average total of 98.47 wt%. The authors suggest the somewhat low totals are a consequence of the platy nature of the crystals. The empirical formula on the basis of (W +Fe + Al = 1) is $(Na_{0.22}H_2O_{0.44}Ca_{0.02}K_{0.003})_{\Sigma 0.683}(W_{0.82}Fe^{3+}_{0.16}Al_{0.02})_{\Sigma 1.00}[O_{2.70}(OH)_{0.30}]_{\Sigma 3.00}$, which simplifies to $(Na,H_2O)_x[(W,Fe)(O,OH)_3]$, x ≈ 0.7

Powder diffraction data was obtained from synchrotron radiation at a wavelength of 0.080 Å. The strongest seven lines in the X-ray powder-diffraction pattern [d_{obs} in Å(I)(hkl)] are: 3.153(100)(00.16,201), 3.111(91)(202,203), 1.823(76)(220), 1.578(64)(22.16), 3.306(62)(116,10.13), 2.450(59)(20.13), and 5.956(52)(102,103). Indexing of X-ray powder diffraction data indicates hexagonal symmetry with space group $P\bar{6}m2$. Refinement of the data resulted in the following unit-cell parameters: $a = 7.286(1)$, $c = 50.49(1)$ Å, $V = 2321.2$ Å^3.

The results of a crystal structure refinement published elsewhere indicate that the structure of pittongite is closely related to that of phyllotungstite $[CaFe_3H(WO_4)_6\cdot 10H_20]$ and that both are derived from the pyrochlore structure by twinning on planes parallel to the 111 plane of the pyrochlore structure. The structure of pittongite is described as a stacking sequence of pyrochlore blocks and hexagonal bronze tungstate layers. TEM studies reveal faults in the stacking order that the authors believe to be due to non-equilibrium conditions during low-temperature formation.

POTASSIC-MAGNESIOHASTINGSITE*

V.G. Korinevskiy, E.V. Korinevskiy (2006) Potassic-Magnesiohastingsite, $(K,Na)Ca_2(Mg,Fe^{2+})_4(Fe^{3+},Al,Ti)[Si_6Al_2O_{22}](OH,Cl)_2$—a new amphibole mineral. Zap. Ross. Mineral. Obshch., 135(2), 49–57 (in Russian, English abstract).

The new clinoamphibole species potassic-magnesiohastingsite comes from Osinovy (Aspen) Cape on the eastern shore of Bolshoy Ishkul Lake, Ilmen Preserve, southern Ural Mountains, Chelyabinsk Oblast', Russia. It is a magmatic phase in blocks of subalkaline biotite-amphibole gabbro that makes up part of the serpentinite mélange of the Ilmen Mountains complex. The rock-forming mineral is associated with calcic plagioclase, barian biotite, titanian magnetite, titanite, apatite, zircon, "fassaite," epidote and celsian. It forms macroscopically black, vitreous, untwinned prismatic crystals to 2–3 cm in length. In thin section it is micropoikilitic, biaxial (–), with low birefringence, strong pleochroism, $2V = -58$ to $-88°$, $c \wedge Z = 11$ to $26°$, with two directions of {110} cleavage at 54 to 58°. Samples from compositionally different gabbro blocks gave (sample 1, sample 2): $\alpha = 1.682$, 1.676 (bright reddish brown-green), $\beta = 1.695$, 1.685 (dark brown-green), $\gamma = 1.702$, 1.692 (very dark bluish green), standard deviation for all measurements = 0.003, absorption is $\gamma > \beta >> \alpha$. Microhardness is 884 to 915 kg/mm², which corresponds to a Mohs' hardness of 6.5.

Analysis by electron microprobe, Mössbauer and infrared spectroscopy, and the Penfield method gave the following averages (sample 1, sample 2): SiO_2 38.59, 36.28; TiO_2 1.64, 1.47; Al_2O_3 13.26, 16.37; V_2O_3 0.09, not det.; Fe_2O_3 unest., 7.29; FeO 18.01 (tot.), 8.76; MnO 0.48, 0.45; MgO 8.98, 10.23; CaO 11.37, 11.84; BaO 0.19, 0.92; Na_2O 1.55, 1.05; K_2O 2.64, 3.34; Cl not det., 0.50; H_2O^+ 1.85, 1.90; H_2O^- 0.08, 0.05; total 98.73, 100.45 (uncorrected for $O = Cl_2$). The resulting formulae are: $(K_{0.53}Na_{0.47})_{\Sigma1.00}(Ca_{1.90}Mn_{0.06}Mg_{0.03}Ba_{0.01})_{\Sigma2.00}(Mg_{2.06}Fe^{2+}_{1.35}Fe^{3+}_{1.00}Al_{0.47}Ti_{0.19}V_{0.01})_{\Sigma5.08}[(Si_{6.03}Al_{1.97})_{\Sigma8.00}O_{22}](OH_{1.93}O_{0.07})_{\Sigma2.00}$ and $(K_{0.65}Na_{0.31}Ba_{0.04})_{\Sigma1.00}(Ca_{1.93}Mn_{0.06}Ba_{0.01})_{\Sigma2.00}(Mg_{2.32}Fe^{2+}_{1.12}Fe^{3+}_{0.84}Al_{0.47}Ti_{0.17})_{\Sigma4.92}[(Si_{5.53}Al_{2.47})_{\Sigma8.00}O_{22}](OH_{1.93}Cl_{0.13})_{\Sigma2.06}$, respectively. Although the composition of the mineral varies from block to block, intracrystalline variation is insignificant. The strongest lines in the X-ray powder diffractogram for sample 1 are [*d* Å, *I* % *hkl*]: 8.48, 100 (110); 3.284, 40 (240); 2.947, 28 (221); 2.820, 28 (330); 2.714, 52 (151), 2.167, 28 (261); and for sample 2: 8.50, 60 (110); 3.385, 41 (131); 3.282, 42 (240); 3.135, 100 (310); 2.720, 45 (151); 2.359, 35 $(42\overline{1})$; 2.168, 29 (261). Refinement of the powder data gives $a = 9.929(9)$, $b = 18.093(4)$, $c = 5.326(7)$ Å, $\beta = 105.326(7)°$ for sample 1 and $a = 9.958(8)$, $b = 18.037(0)$, $c = 5.346(5)$ Å, $\beta = 105.498(0)°$ for sample 2. Type material has been deposited with the A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow (catalog no. 3188/1).

Discussion. The space group is not given; it is presumably *C*2/*m*. **T.S.E.**

NEW DATA

BORTNIKOVITE*

A.G. Mochalov, M.D. Tolkachev, Y.S. Polekhovsky, E.M. Gorycheva (2007) Bortnikovite, Pd_4Cu_3Zn, a new mineral species from the unique Konder placer deposit, Khabarovsk krai, Russia. Geology of Ore Deposits, 49(4), 318–327.

Bortnikovite occurs as steel-white, metallic overgrowth rims of approximately 50–150 μm on larger isoferroplatinum grains. The contact between the two minerals is sharp. The mineral is opaque, has no observed cleavage and has a low malleability. Microindentation measurements with (VHN load 50 g) gave a mean value of 367.9 kg/mm². Electron microprobe analyses (average of 18 analyses) gave Pt 4.06, Pd 58.19, Fe 1.41, Cu 27.26, Zn 8.02, sum 98.94%, corresponding to $(Pd_{3.822}Pt_{0.145})_{3.967}Cu_{2.998}(Zn_{0.857}Fe_{0.177})_{1.034}$, based on 8 atoms. The ideal formula is Pd_4Cu_3Zn. Reflectance percentages for $R_{average}$ are 56.9 (470 nm), 61.7 (546 nm), 63.4 (589 nm), and 65.4 (650 nm) respectively.

Bortnikovite is assumed to be tetragonal *P*4/*mmm*, with unit-cell parameters refined from X-ray diffraction data, using the CsCl structure as a reference, $a = 6.00(2)$, $c = 8.50(3)$ Å, $V = 306.00(1)$ Å³; $c{:}a = 1.4167$, Z = 4, $D_{calc} = 11.16$ g/cm³. The strongest lines on the X-ray diffraction pattern (57.3 mm Gandolfi camera and RKD-57.3 camera, 10 lines) include [*d* Å (*I*%, *hkl*)]: 2.13(100,004,220), 1.501(30,400,224), 1.346(20,240,332), 1.224(80,404), 1.059(40,440).

The mineral is from the Konder PGM placer deposit in the Ayan-Maya district of Khabarovsk Krai, Russia. It is a large 0.36 by 60 km alluvial placer with the Konder alkaline ultramafic massif as its primary source, and dunite being the primary source of the PGM themselves. It is associated closely with isoferroplatinum, titanite, perovskite, V-bearing magnetite, bornite, and chlorite. Isoferroplatinum from the Konder placer is known to host many PGM and other rare mineral species as inclusions or intergrowths. Bortnikovite is the fifth new PGM described from the locality. The mineral was named after Professor Nikolai Stefanovich Bortnikov, mineralogist and researcher at the Russian Academy of Sciences. The type material was deposited at the Mineralogical Museum at the St. Petersburg State University. **R.R.**

KAMPFITE*

L.C. Basciano, L.A. Groat (2007) The crystal structure of kampfite. Can. Mineral., 45, 935–943.

Kampfite was originally described in 2001 by Basciano et al., as hexagonal (uniaxial) with possible space groups $P6_3/mmc$, $P\overline{6}2c$, $P6_3mc$, $P\overline{3}1c$, and $P31c$ and an ideal formula of $Ba_6[(Si,Al)O_2]_8(CO_3)_2Cl_2(Cl,H_2O)_2$. The precession single crystal photographs were suggesting a hexagonal cell, but another grain studied was biaxial negative. A new crystal structure on a better crystal was thought necessary due to the fact that the crystal initially used was thought to be made of two individuals and that further optical work done on several crystals yielded biaxial optics.

A cleavage fragment free of any inclusion from the Esquire no. 1 claim at Rush Creek, Fresno, California was used for the new structure determination. Electron microprobe analyses (10 analyses) gave CO_2 10.74, SiO_2 19.75, TiO_2 0.11, Al_2O_3 8.06, SrO 0.10, BaO 56.74, Na_2O 0.06, Cl 5.33, O = Cl –1.20, sum 99.69 wt%, corresponding to $(Ba_{12.12}Na_{0.06}Sr_{0.03})_{\Sigma12.21}(Si_{10.77}Al_{5.18}Ti_{0.05})_{\Sigma16.00}C_{8.00}O_{55.14}Cl_{4.93}$ based on 16 *T* (Si^{4+} + Ti^{4+} +

Al^{3+}) and 8 C cations. It differs from the first studied material by the absence of structural H_2O, which is assumed to have been caused by hydrous inclusion. The new ideal formula is $Ba_{12}(Si_{11}Al_5)O_{31}(CO_3)_8Cl_5$.

The mineral is now defined as monoclinic, space group Cc, $a = 31.2329(7)$, $b = 5.2398(1)$, $c = 9.0966(3)$ Å, $\beta = 106.933(2)°$, $V = 1424.2(1)$ Å^3, $Z = 1$, $D_{calc} = 3.809$ g/cm^3. The structure was refined with a four-circle diffractometer and a CCD detector using 2938 observed [$F_o > 4\sigma(F_o)$, Mo$K\alpha$] single-crystal reflections to $R_{index} = 2.3\%$. The strongest lines in the X-ray powder diffractogram with a Bruker D8 Discover microdiffractometer (26 lines) are [d Å($I\%$, hkl)]: 14.883(46,200), 4.348(18,$1\bar{1}1$,111,$31\bar{1}$, $3\bar{1}\bar{1}$), 3.879(100,202,$60\bar{2}$,$3\bar{1}1$,$3\bar{1}1$,$5\bar{1}1$,511) 3.355(31,402,$80\bar{2}$, $5\bar{1}1$,511,$7\bar{1}\bar{1}$, $71\bar{1}$), 2.883(27,602,$10.0\bar{2}$,$7\bar{1}1$,711,$9\bar{1}\bar{1}$,$91\bar{1}$), 2.621(63,$31\bar{3}$,$3\bar{1}\bar{3}$,020), 2.173(20,004,$80\bar{4}$,$2\bar{2}2$,222,$6\bar{2}\bar{2}$, $62\bar{2}$), 1.970(21,$7\bar{1}3$,713,$13.1.\bar{3}$,$13.\bar{1}\bar{3}$,$10.\bar{2}0$,10.2.0). **R.R.**

NACAPHITE*

S.V. Krivovichev, V.N. Yakovenchuk, G.Y. Ivanyuk, Y.A. Pakhomovsky, T. Armbruster, E.A. Selivanova (2007), The crystal structure of nacaphite, $Na_2Ca(PO_4)F$: a re-investigation. Can. Mineral., 45, 915–920.

Previous studies of nacaphite were carried out on 0.1 mm inclusions in thermonatrite. Recent investigation of hydrothermal assemblages from the Khibiny alkaline massif revealed large untwinned crystals of nacaphite. These crystals are up to 2 cm long and 3 mm in diameter and occur interstitially to nepheline, potassic arfvedsonite, microcline and eudialyte. WDS and powder diffraction results from the new material are similar to the initial studies, but optical data is significantly different [biaxial (+), $\alpha = 1.536(2)$, $\beta = 1.528(2)$, $\gamma = 1.524(5)$, $2V_{meas} = 65 \pm 5°$ (current study) and biaxial (–), $\alpha = 1.508$, $\beta = 1.515$, $\gamma = 1.520$, $2V_{meas} = 80°$ (Khomyakov et al. 1980)].

Initial work gave a C-centered orthorhombic cell with the following parameters: $a = 10.650$, $b = 24.425$, $c = 7.097$ Å, $\alpha = 89.99$, $\beta = 90.00$, $\gamma = 90.04°$; entirely in agreement with the earlier studies. Further study of the data showed a strong preference for a monoclinic subcell which has dimensions of $a = 10.650$, $b = 7.097$, $c = 13.319$ Å, $\alpha = 90.00$, $\beta = 113.53$, $\gamma = 90.00°$. The use of this subcell significantly improves R values. Refinement of the monoclinic subcell gave a space group of $P2_1/c$. The results of this refinement are in good agreement with the powder diffraction data obtained in earlier studies.

The authors believe that the differences between the current and earlier studies are the result of pseudomerohedral twinning in earlier samples. The overall topology of the earlier crystal structure refinements agree with the current study, but there are two differences in order and local coordination geometry; in the new structure the Na^+ and Ca^{2+} cations are completely ordered and the sites are completely filled. In addition, the Ca^{2+} cations have two types of sevenfold coordination while the Na^+ cations are octahedrally coordinated. **G.P.**