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NEW MINERAL NAMES*

John L. Jambor
CANMET, 555 Booth Street, Ottawa, Ontario K1A 0G1, Canada
Edward S. Grew
Department of Geological Sciences, University of Maine, Orono, Maine 04469, U.S.A.

Trembathite*

P.C. Burns, F.C. Hawthorne, J.A.R. Stirling (1992) Trembathite, $(Mg,Fe)_3B_7O_{13}Cl$, a new borate mineral from the Salt Springs potash deposit, Sussex, New Brunswick. Can. Mineral., 30, 445–448.

Electron microprobe analysis of a zoned crystal gave an average and range of MgO 22.02 (13.33–23.32), MnO 0.49 (0.34–1.04), FeO 13.59 (12.54–23.04), CaO 0.01 (0.00–0.01), Cl 9.29 (8.36–9.55), B_2O_3 (calc.) 57.33 (54.44–57.68), Cl ≡ O 2.09 (1.89–2.15), sum 100.63 wt%, corresponding to $(Mg_{2.29}Fe_{0.79}Mn_{0.03})_{\Sigma 3.11}B_{6.89}O_{12.90}Cl_{1.10}$, ideally $(Mg,Fe)_3B_7O_{13}Cl$. The mineral occurs as colorless to light blue rhombohedra <2 mm across, some clustered. Vitreous luster, transparent, white streak, estimated H = 6–8, conchoidal fracture, D_{meas} = 2.84–3.34 g/cm³ depending on Mg-Fe ratio. Optically polysynthetically twinned, uniaxial negative, $\omega = 1.684(2)$, $\epsilon = 1.668(2)$. Rietveld structure refinement confirmed isostructuralism with congolite ($Fe_3B_7O_{13}Cl$), rhombohedral symmetry, space group $R3c$, $a = 8.574(2)$, $c = 20.99(1)$ Å. Strongest lines of the powder pattern (diffractometer, Cu$K\alpha$ radiation) are 3.497(34,202,006), 3.028(100,024), 2.711(66,122,116), 2.144(37,220,208), 2.050(73,131,223,217,119), and 1.828(25,042,226). The mineral occurs in massive halite in a drill core from Mississippian evaporite deposits near Sussex, New Brunswick. The new name is for L. T. Trembath of the University of New Brunswick. Cotype material is in the Royal Ontario Museum, Toronto. The mineral is the Mg analogue of congolite and the rhombohedral dimorph of boracite. **J.L.J.**

$(Pd,Cu)_3Sn$

M. Ohnenstetter (1992) Platinum group element enrichment in the upper mantle peridotites of the Monte Maggiore ophiolitic massif (Corsica, France): Mineralogical evidence for ore-fluid metasomatism. Mineral. Petrology, 46, 85–107.

Energy dispersion analysis of a single euhedral grain, an inclusion approximately 0.8 × 0.8 μm in pentlandite, gave S 15.0, Fe 11.6, Ni 10.9, Cu 7.6, Pd 33.8, Sn 16.7 wt%; after exclusion of the effects from pentlandite and recalculation to 100 wt%: Pd 58.2, Cu 13.1, Sn 28.7, corresponding to $(Pd_{2.21}Cu_{0.82})_{\Sigma 3.03}Sn_{0.97}$, ideally $(Pd,Cu)_3Sn$, the Cu-bearing Pd analogue of rustenbergite. The grain is square in outline.

Discussion. The composition is similar to that of taimyrite, $(Pd,Cu,Pt)_3Sn$, which is reported to be orthorhombic. See the discussion in *Am. Mineral.,* 68, 1252 (1983). **J.L.J.**

$Pt_2(As,S)_3$, IrAsSb, $Pt_3(Sb,Sn,Bi)_4$, $Pt_2(Sb,Bi)_3$

S.A. Shcheka, A.A. Vrzhosek, V.I. Sapin, N.I. Kiryukhina (1991) Transformations of platinum-group minerals from Primor'ye placers. Mineral. Zhurnal, 13(1), 31–40 (in Russian).

The unnamed minerals are from a placer near the boundary between the activated Khankay crystalline massif and the Permian Khasan-Grodekov trough, which are located in the western Primor'ye, near Vladivostok, Russia. In addition to metals of the Pt group (in grains averaging 0.3–0.4 mm, but reaching 3 mm), the heavy-mineral fraction includes chromite, ilmenite, cassiterite, wolframite, Au, arsenopyrite, molybdenite, cinnabar, and galena. Material rich in Pt, Ir, and Os is inferred to have been originally derived from zoned ultramafic intrusions and subsequently reworked by hydrothermal solutions rich in As, Sb, Bi, and Sn associated with granitoid magmas, such that the Pt metals were partly replaced by other compounds, including the unnamed minerals.

$Pt_2(As,S)_3$

Electron microprobe analysis gave Pt 53.33, Pd 1.28, Rh 6.20, Ru 0.05, Cu 0.14, Ni 0.05, Fe 1.80, Sb 0.25, As 33.98, S 3.54, sum 100.62 wt%, corresponding to $(Pt_{1.44}Rh_{0.32}Fe_{0.17}Pd_{0.06}Cu_{0.01})_{\Sigma 2.01}(As_{2.39}S_{0.58}Sb_{0.01})_{\Sigma 2.99}$ (normalized to $\Sigma = 5$ cations). The mineral is isotropic, green-gray tint in reflected light, darker and with a higher relief than isoferroplatinum. Occurs as a rim 50 μm thick around an isoferroplatinum core in a single grain; a zone 2 μm thick of cooperite intervenes; $Pt_2(As,S)_3$ also corrodes and penetrates the isoferroplatinum core along fractures.

IrAsSb

Electron microprobe analysis gave Pt 0.43, Ir 47.50, Os 1.87, Pd 0.12, Rh 0.19, Ru 0.13, Cu 0.52, Sb 29.53, As 19.89, sum 100.18 wt%, corresponding to $(Ir_{0.95}Os_{0.04}Cu_{0.03}Rh_{0.01}Pt_{0.01})_{\Sigma 1.05}As_{1.02}Sb_{0.93}$ (normalized to $\Sigma = 3$ cations). Isotropic, brownish gray tint in reflected

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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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light, somewhat more reflecting and with a lower relief than irarsite. The mineral forms a zone 100–120 μm thick around an osmiridium core that is zoned successively inward as follows: (1) an outermost, discontinuous rim of irarsite; (2) unnamed IrAsSb with rare osmiridium plates; (3) an irarsite zone, 2–5 μm thick; (4) Os-rich osmiridium; and (5) osmiridium and irarsite with the two unnamed minerals described below. In places, acicular irarsite penetrates the unnamed IrAsSb, and irarsite zones 1 and 3 are joined across the zone of IrAsSb.

$Pt_3(Sb,Sn,Bi)_4$

Electron microprobe analysis gave Pt 32.11, Ir 18.51, Os 17.82, Sb 23.88, Sn 5.96, Bi 1.74, sum 100.02 wt%, corresponding to $(Pt_{1.35}Ir_{0.79}Os_{0.77})_{\Sigma 2.91}(Sb_{1.61}Sn_{0.41}Bi_{0.07})_{\Sigma 2.09}$ (normalized to $\Sigma = 5$ cations). The Os and Ir are attributed to interference from the surrounding osmiridium, and the formula is inferred to be $Pt_3(Sb,Sn,Bi)_4$. The mineral forms plates, 0.5–4 μm across, in the interstices among plates of osmiridium and irarsite in the innermost zone around the osmiridium core of the grain described above (unnamed IrAsSb). In reflected light, strongly anisotropic, light brown with a distinct orange tint, bireflectant from orange-brown to gray. Reflectance is 9–10% greater than that of irarsite.

$Pt_2(Sb,Bi)_3$

Electron microprobe analysis gave Pt 24.72, Ir 20.40, Os 4.76, Sb 44.31, Bi 5.88, sum 100.07 wt%, corresponding to $(Pt_{0.98}Ir_{0.82}Os_{0.19})_{\Sigma 1.98}(Sb_{2.80}Bi_{0.22})_{\Sigma 3.02}$ (normalized to $\Sigma = 5$ cations). Forms angular aggregates of plates, 0.5–4 μm across, in a few of the interstices among osmiridium and irarsite in the innermost zone around the osmiridium core of the grain described above (unnamed IrAsSb). The mineral is anisotropic, bireflectant from brownish to dark gray, and lighter than irarsite.

Discussion. IrAsSb is known as a synthetic compound, but the phase is monoclinic. Osmiridium is no longer a valid name (= iridium). **E.S.G.**

γ-CrO(OH)

A.I. Gorshkov, V.N. Demina, A.V. Mokhov, V.V. Zhukov, V.N. Korotkin, T.A. Ziborova (1991) A new chromium γ-hydroxide in bauxite ores of the Severoonezhkoye deposit. Doklady Akad. Nauk SSSR, 320(6), 1455–1458 (in Russian).

Energy dispersion microprobe analyses gave Al_2O_3 19.83, TiO_2 1.51, V_2O_3 1.84, Cr_2O_3 72.33, Fe_2O_3 3.50, NiO 0.98, sum 100 wt% by normalization, which corresponds to $Cr_{0.66}Al_{0.27}Fe_{0.03}Ti_{0.01}V_{0.02}Ni_{0.01}O(OH)$ if one assumes ideal OH content. The infrared spectrum has bands at 475, 570, 1040, 3180, 3370, and 3440 cm^{-1}, which are attributed to OH with strong H bonds, metal-OH, or metal-O bonds. The spectrum suggests that the structure of this mineral is close to those of lepidocrocite and böhmite. Electronograms (X-ray analysis was not feasible) gave only annular reflections: 6.24(strong, 020), 3.3(medium strong, 021), 2.45(strong, broad, 130), 2.36(—,111), 1.93(medium, 002,150), 1.86(weak, 022), 1.72(very weak, 151), 1.52 (medium, 132), 1.35(medium weak, 151), and 1.186(weak, 0.10.1). The pattern is similar to that of finely dispersed lepidocrocite. By analogy with this mineral, the pattern was indexed as orthorhombic, space group *Cmcm*. Cell parameters calculated by least squares are $a = 3.02$, $b = 12.44$, $c = 3.86$ Å. TEM showed the mineral to be finely fibrous polycrystalline aggregates, in which individual fibers are ≤ 0.1 μm long and ≤ 0.015 μm thick. Bauxite containing this mineral was collected from the base of the bauxite-bearing layers in the Severoonezhskiy deposit in Devonian sediments of the northwest part of the Russian Platform, Russia. The mineral occurs in a dispersed state and constitutes only a few tenths of a percent of Cr-rich bauxite ($\leq 30\%$ Cr_2O_3). Previous investigators reported gibbsite, kaolinite, goethite, and hematite in association with chromium hydroxide and chromian böhmite from this deposit. The appearance of chromium hydroxide is attributed to low SiO_2 activities. Cr and Ni, constituents not normally enriched in bauxite, are inferred to have originated from the weathering of mafic and ultramafic rocks. **E.S.G.**

Cl-dominant kettnerite

M.I. Novgorodova, M.Ye. Generalov, A.I. Gorshkov, A.V. Sivtsov, Ye.I. Uspenskiy (1991) Association of native gold with bismuthyl carbonates and tellurates. Izvestiya Akad. Nauk SSSR, Ser. Geol., No. 4, 102–108 (in Russian).

Electron microprobe analyses of two spots gave Ca 5.62, 6.37, Te 1.57, 1.57, Bi 68.32, 66.78, Cl 6.24, 2.87 wt%. These results are interpreted as representing the composition of a finely dispersed mixture of Cl-dominant kettnerite, $Ca(BiO)Cl(CO_3)$, and beyerite with minor montanite and bismite, in which individual particles are a fraction of a micrometer across. In reflected light the Ca-Bi carbonates are light gray with grayish white internal reflections. The material is not suitable for X-ray study. Electronograms on (001) plates are consistent with tetragonal symmetry, space group *P4/mmm*; some platelets gave $a \approx 3.8$, $c \approx 11$ Å, whereas others gave $a \approx 7.56$, $c \approx 11$ Å, that is, the unit cell is quadrupled, not doubled as the authors assert, which suggests that the ordering scheme for Bi and Ca could be different. Cl-dominant kettnerite commonly forms finely layered intergrowths with beyerite on (001); these intergrowths are on the order of tenths of a micrometer to 1–5 μm and more across. The Bi-Ca carbonates, montanite, and bismite occur with unoxidized Bi and hedleyite in calcite in Au-impregnated calcite-chlorite segregations in the cores of veins that cut Upper Silurian dolomite marble in the exocontact of the Chinorsay granodiorite massif at the Kudul locality, Tajikistan. The Bi minerals are interpreted as having formed at temperatures of ≥ 220 °C from the interaction of highly oxidizing solutions, possibly originating from the mixing of hydrothermal fluids and vadose (i.e., aerated) H_2O. **E.S.G.**

Zn schulenbergite

A. Livingstone, B. Jackson, P.J. Davidson (1992) The zinc analogue of schulenbergite, from Ramsbeck, Germany. Mineral. Mag., 56, 215–219.

Wet chemical analysis and TGA gave ZnO 46.04, CuO 15.37, SO_3 15.16, H_2O^+ 17.21, H_2O^- 0.91, CO_2 1.32, sum 96.01 wt% after correction for 1.1 wt% gypsum. After recalculation to 100 wt%, the analysis corresponds to $(Zn_{5.07}Cu_{1.73})_{\Sigma 6.80}[(SO_4)_{1.70}(CO_3)_{0.27}]_{\Sigma 1.97}(OH)_{9.66}\cdot 3.74H_2O$. The mineral is unstable under the electron beam of the microprobe; the range obtained from the analysis of 14 grains is ZnO 44.71–53.72, CuO 15.79–19.35, SO_3 14.32–16.20 wt%. X-ray powder data (114-mm camera, Fe radiation) gave strongest lines of 7.255(100,001), 3.623(70,002,111), 3.236(70,102), 2.719(80,112,210), and 2.542(80,211), which by analogy with schulenbergite gives hexagonal cell dimensions of a = 8.293(2), c = 7.247(4) Å. The mineral occurs as pale blue-green hexagonal- and trigonal-shaped plates, 150 × 100 × 50 μm, that form scaly aggregates to 0.3 mm. Perfect {0001} cleavage and a good cleavage parallel to trigonal prism faces, nonfluorescent, pearly luster, $H = 1–2$, $D_{meas} = 3.25$, $D_{calc} = 3.27$ g/cm³ with $Z = 1$. Optically uniaxial, $\omega = 1.650(3)$, $\epsilon = 1.634(3)$. The mineral occurs as a coating on a slaty specimen from the Bastenberg mine, near Ramsbeck, Nord-Rhein Westfalen, Germany. The results suggest that the mineral is the Zn-dominant analogue of schulenbergite $(Cu,Zn)_7(SO_4,CO_3)_2(OH)_{10}\cdot 3H_2O$. **J.L.J.**

$Na_3Sr(PO_4)(CO_3)$

E.V. Sokolova, A.P. Komyakov (1992) Crystal structure of the new bradleyite-group mineral $Na_3Sr[PO_4](CO_3)$. Doklady Akad. Nauk SSSR, 322(3), 531–535 (in Russian).

Chemical analysis (not given) of a mineral from the Khibiny alkaline massif, Russia, gave the formula $Na_3Sr(PO_4)(CO_3)$, corresponding to the Sr analogue of bradleyite $Na_3Mg(PO_4)(CO_3)$, sidorenkite $Na_3Mn(PO_4)(CO_3)$, and bonshtedtite $Na_3Fe(PO_4)(CO_3)$. X-ray structure analysis (R = 0.039) indicated monoclinic symmetry, space group $P2_1$, a = 9.187(3), b = 5.279(1), c = 6.707(2) Å, γ = 89.98(3)°, $D_{meas} = 3.05$, $D_{calc} = 3.18$ g/cm³ with $Z = 2$. Despite the analogous chemical formulae and general similarity in cell parameters, the Sr mineral does not have a structure identical to that of the bradleyite-type minerals. **J.L.J.**

$NaBSiO_4$

Ye.V. Sokolova, A.P. Khomyakov (1991) The crystal structure of a new natural Na-borosilicate with a framework of the tridymite type. Doklady Akad. Nauk SSSR, 319(4), 879–883 (in Russian).

No chemical analyses are given. Crystals of the mineral are colorless but are clouded by an abundance of fluid inclusions. Single-crystal X-ray diffractometer study gave a = 8.035(3), c = 7.703(2) Å, V = 430.7(2) Å³, and crystal structure refinement indicated that the mineral is hexagonal, space group $P6_3$. No powder X-ray data are given. The mineral is a derivative of β-tridymite, that is, one of the kalsilite group. Occurs with ussingite in ultra-agpaitic pegmatites at Lovozero, Kola Peninsula, Russia. The mineral is reported to be identical to the hexagonal modification of $NaBSiO_4$ reported from Mont St. Hilaire, Canada, by Chao et al. (*Mineral. Record,* 21(4), 363–368, 1990). **E.S.G.**

Si-dominant cancrinite

A.P. Khomyakov, E.A. Pobedimskaya, T.N. Nadezhina, L.E. Terenteva, R.K. Rastsvetaeva (1991) Structural mineralogy of high-Si cancrinite. Moscow Univ. Geol. Bull., 46(5), 71–75 (English translation from Vestnik Mosk. Univ. Geol.).

Chemical analysis gave Na_2O 21.30, K_2O 0.10, CaO 0.68, MgO 0.11, Fe_2O_3 0.33, Al_2O_3 24.42, SiO_2 43.11, CO_2 4.82, SO_3 0.36, H_2O 5.01 wt%, corresponding to $(Na_{6.89}Ca_{0.12}Mg_{0.03}K_{0.02})_{\Sigma 7.06}(Si_{7.20}Al_{4.90})_{\Sigma 12.00}O_{24.02}(CO_3)_{1.10}(SO_4)_{0.04}\cdot 2.79H_2O$. X-ray crystal-structure analysis (R = 0.029) leads to the crystallochemical formula $Na_{7.2}[Si_{7.2}Al_{4.8}O_{24}](CO_3)_{1.2}\cdot 3H_2O$, hexagonal symmetry, space group $P6_3mc$, a = 12.575(3), c = 5.105(2) Å. The mineral is bright lilac colored, vitreous luster, transparent, conchoidal fracture, D_{meas} = 2.40 g/cm³; optically uniaxial negative, ω = 1.509, ϵ = 1.490, bright yellow luminescence in ultraviolet light. Infrared spectra and X-ray powder data (not given) are similar to those of normal cancrinite, in which Si/Al = 1; in the Si-rich phase the 12 formula atoms of Si and Al are distributed as 7.2 Si and 4.8 Al, so that Si/Al = 1.5. The mineral occurs in irregular pockets, 10–15 mm in size, in ultra-agpaitic pegmatites in the Alluaiv region, northwestern part of the Lovozero alkaline massif, Russia. The localization of the atoms of the aluminosilicate framework within the nonstandard space group $P6_3mc$ is an indication of a new Si-dominant species in the cancrinite group. **J.L.J.**

New Data

Abhurite

R. Edwards, R.D. Gillard, P.A. Williams (1992) The stabilities of secondary tin minerals: abhurite and its relationships to Sn(II) and Sn(IV) oxides and oxyhydroxides. Mineral. Mag., 56, 221–226.

Abhurite, an alteration product of Sn ingots recovered from a shipwreck in the Red Sea, was originally assigned the formula $Sn_3Cl_2(OH)_2O$, rhombohedral symmetry, space group $R\bar{3}m$, $R3m$, or $R32$, $a = 10.0175(3)$, $c = 44.014(2)$ Å, $Z = 21$, $D_{meas} = 4.29$, $D_{calc} = 4.35$ g/cm³ (Abstract in *Am. Mineral.*, 74, p. 500, 1989). It is pointed out that the X-ray crystal structure of this phase was determined by von Schnering et al. (*Zeits. Naturforsch.*, 36b, 1551–1560, 1981), who showed it to be rhombohedral, space group $R32$, $a = 10.018(1)$, $c = 44.030(2)$ Å, $D_{meas} = 4.42$, $D_{calc} = 4.417(1)$ g/cm³ for $Sn_{21}Cl_{16}(OH)_{14}O_6$ with $Z = 3$. X-ray powder diffraction data for the structurally determined phase also are in good agreement with those of abhurite. Under the natural saline conditions typical of seawater, romarchite or hydroromarchite is the stable phase; with higher salinity and reduction in pH, the formation of abhurite is favored. **J.L.J.**

Bannisterite

P.J. Heaney, J.E. Post, H.T. Evans, Jr. (1992) The crystal structure of bannisterite. Clays Clay Minerals, 40, 129–144.

X-ray structural study of bannisterite from Franklin Furnace, New Jersey ($R = 0.034$), and Broken Hill, Australia ($R = 0.039$), gave monoclinic symmetry, space group $A2/a$, $a = 22.265(1)$, $b = 16.368(1)$, $c = 24.668(2)$ Å, $\beta = 94.285(5)°$ for the mineral from Franklin Furnace (similar dimensions for Broken Hill). The idealized formula is $Ca_{0.5}K_{0.5}M_{10}[Si_{14.5}Al_{1.5}]O_{38}(OH)_8 \cdot nH_2O$ where M = (Fe,Mn,Zn,Mg) and n ranges from 2 to 6. The mineral is a modulated, mica-like species that has a modified 2:1 layer structure in which Ca, K, and H_2O are highly disordered. **J.L.J.**

Lutecite

A.A. Godovikov, S.N. Nenasheva, V.S. Pavlyuchenko, O.I. Ripinen (1991) New finds of lutecine. Doklady Akad. Nauk SSSR, 320(2), 428–433 (in Russian).

No chemical analyses are given. The mineral forms pseudohexagonal dipyramidal aggregates, several millimeters across, consisting of a sagenitic network of very fine needles oriented at about 120° to one another, which corresponds to the Brazil twin law. These needles have positive elongation and an extinction angle of about 27°, as viewed in sections cut to be perpendicular to the networks. The strongest lines (44 given) in the X-ray powder pattern (diffractometer, Cu$K\alpha$ radiation), which were indexed using the parameters $a = 8.770$, $b = 4.879$, $c = 10.720$ Å, $\beta = 90.08°$ for moganite from Miehe et al. (*Zeits. Kristallogr.*, 182, p. 183–184, 1988) are 4.26(50,110), 3.33(100 broad, 112), 2.27(50,312), 1.803(80,024), 1.536(50,$\bar{3}$24), 1.370(60 broad, $\bar{2}$26), and 1.175(50,240). These lines correspond to the strongest ones in quartz. Many weaker lines have no equivalents in the quartz pattern, but they do have equivalents in the moganite pattern, to which the overall pattern bears close resemblance. The d values calculated from cell parameters of Miehe et al. (1988) for moganite are in good agreement with the observed values, except for weak, low-angle lines observed at 6.55, 6.06, and 5.47 Å. The lutecite sagenitic network is intergrown with chalcedony and quartz. The dipyramidal aggregates form crusts, amygdules (to 15 cm across), nests (to 40 cm), and veinlets (to 4 cm thick, several meters long), that are found in gas bubbles, fractures, and cavities at agate localities associated with upper Jurassic through Lower Cretaceous basalts in the eastern part of the Arz-Bord Range, northwestern Gobi, Mongolia. In some gas bubbles, the aggregates have grown on calcite, aragonite, and jasper. It is suggested that moganite and lutecite are the same mineral and that because the name lutecite has priority, it should be applied to this mineral.

Discussion. Moganite was disapproved by the IMA (see *Am. Mineral.*, 70, p. 874, 1985, and 75, p. 1435, 1990). The data given in the present paper are not sufficient to define this material as a new mineral species under the name lutecite. The significance of the inclined extinction is unclear, as it is not defined relative to a crystallographic axis. The sagenitic networks could be intergrowths of plates that appear in thin section as needles, rather than intergrowths of needles. Another unanswered question is whether the X-ray diffraction lines that have no equivalents in quartz could be due to impurities present in the sagenitic net. **E.S.G.**

Mckelveyite-(Nd), Mckelveyite-(Y)

A.V. Voloshin, V.V. Subbotin, V.N. Yakovenchuk, Ya.A. Pakhomovskiy, Yu.P. Men'shikov, A.N. Zaytsev (1990) Mckelveyite from carbonatites and hydrothermal metasomatites of Kola Peninsula alkaline rocks (first findings in the USSR). Zapiski Vses. Mineral. Obshch., 119(6), 76–86 (in Russian).

Mckelveyite-(Y)

Electron microprobe analyses of samples from the Khibiny, Sallanlatvi, and Vuoriyarvi massifs (Kola Peninsula, Russia) gave, respectively, SrO 2.17, 10.22, 9.45, BaO 41.55, 30.81, 34.11, Na_2O 3.92, 3.60, 3.83, CaO 5.17, 4.86, 5.62, Y_2O_3 8.65, 6.02, 6.70, La_2O_3 –, 0.06, –, Ce_2O_3 –, 0.19, –, Sm_2O_3 –, 0.34, 0.57, Eu_2O_3 –, 0.47, 0.36, Gd_2O_3 –, 2.04, 0.92, Tb_2O_3 –, –, 0.13, Dy_2O_3 0.05, 1.75, 1.36, Ho_2O_3 –, 0.40, 0.42, Er_2O_3 0.59, 0.44, 0.74, Yb_2O_3 0.67, 0.04, 0.23, sums 62.77, 61.24, 64.44 wt%. For CO_2 contents calculated to give nearly 2 CO_2 per formula unit (respectively, 25.19, 25.18, 26.55), H_2O contents are calculated to be, respectively, 12.04, 13.58, 9.01, to bring analytical totals to 100 wt%. The resulting formulae are, respectively, $(Sr_{0.07}Ba_{0.91})_{\Sigma 0.98}(Na_{0.43}Ca_{0.31}Y_{0.26}Er_{0.01}Yb_{0.01})_{\Sigma 1.02}(CO_3)_{1.93} \cdot 4.50H_2O$, $(Sr_{0.34}Ba_{0.68})_{\Sigma 1.02}(Na_{0.40}Ca_{0.30}Y_{0.18}Sm_{0.01}Eu_{0.01}Gd_{0.04}Dy_{0.03}Ho_{0.01}Er_{0.01})_{\Sigma 0.99}(CO_3)_{1.95} \cdot 5.12H_2O$, and $(Sr_{0.29}Ba_{0.71})_{\Sigma 1.00}Na_{0.40}Ca_{0.32}Y_{0.19}Sm_{0.01}Eu_{0.01}Gd_{0.02}Dy_{0.02}Ho_{0.01}Er_{0.01})_{\Sigma 0.99}(CO_3)_{1.94} \cdot 3.22H_2O$. Some crystals from Khibiny are zoned with Sr enrichment outward, so that Sr > Ba in the rims; that is, a transition from mckelveyite-(Y) to donnayite-(Y) is observed. H_2O content indicated by weight loss between 300 and 350 °C during thermic analysis of Khibiny material is 6.3 wt%. The infrared spectrum (locality unspecified) contains absorption features at 3250, 1700, 1490, 1390, 1080, 870, 730, 700, and 665 cm^{-1} and is similar to that for donnayite. $H = 3.5–4$. No cleavage. Fracture uneven. Varieties include (1) greenish gray, translucent, colorless in thin section, optically uniaxial negative, $\omega = 1.652$, $\epsilon = 1.553$ (Khibiny); (2) white or gray with yellow tint, $\omega = 1.658$, $\epsilon = 1.554$ (Khibiny); (3) reddish brown or brown, opaque (Khibiny, Vuoriyarvi); (4) brown, opaque, pinkish in thin section, nonpleochroic, optically uniaxial negative, $\omega = 1.649$, $\epsilon = 1.550$ (Sallanlatvi). Assuming a triclinic cell, powder X-ray data (114.6-mm camera, Cr$K\alpha$ radiation, NaCl standard) of the Sallanlatvi material gave $a = 9.142$, $b = 9.141$, $c = 7.000$ Å, $\alpha = 102.51$, $\beta = 115.67$, $\gamma = 59.99°$, $V = 456.6$ $Å^3$. Strongest lines (26 given) are 6.36(50,001), 4.46(90,211), 4.12(50,121), 3.294(50,121), 2.915(100,211), 2.638(80,331), 2.435(50,031), 2.264(60,421), 2.057(50,242), 2.024(70,333), 1.954(50,423), and 1.716(50,542). The mineral forms barrel-shaped pseudohexagonal crystals up to 3 cm with sector zoning (Khibiny), disk-shaped pseudorhombohedral crystals up to 3 mm across (Khibiny), or platy aggregates (Sallanlatvi, Vuoriyarvi). In the Khibiny massif, mckelveyite occurs in an aegirine-feldspar-natrolite-calcite vein in syenite and in a siderite-ankerite-natrolite vein in carbonatized foyaite, as well as in cataclastic albitite in the contact zone of the massif; in the Sallanlatvi and Vuoriyarvi massifs, occurs in solution cavities in carbonatite. Associated minerals include sphalerite, galena, pyrite, barite, strontianite, fluorite, ancylite, ewaldite, cordylite, donnayite, vinogradovite, catapleiite, epididymite, zhonghuacerite, orthoclase, zircon, and burbankite.

Mckelveyite-(Nd)

Electron microprobe analyses of two samples from Vuoriyarvi gave SrO 5.91, 8.99, BaO 33.42, 29.86, Na_2O 4.60, –, CaO 4.34, 4.20, Y_2O_3 –, –, La_2O_3 3.31, 1.08, Ce_2O_3 3.83, 2.02, Pr_2O_3 0.78, 0.83, Nd_2O_3 5.13, 5.14, Sm_2O_3 1.96, 3.60, Eu_2O_3 0.54, 0.87, Gd_2O_3 0.96, 1.59, Dy_2O_3 –, 0.14, sums 64.78, 58.32 wt%. For CO_2 contents calculated to give about 2 CO_2 per formula unit (respectively 25.27, 21.60), H_2O contents are calculated to be 9.95 and 20.08, to bring analytical totals to 100 wt%. The resulting formulae are $(Sr_{0.19}Ba_{0.73})_{\Sigma 0.92}(Na_{0.50}Ca_{0.26}La_{0.07}Ce_{0.08}Pr_{0.02}Nd_{0.10}Sm_{0.04}Eu_{0.01}Gd_{0.02})_{\Sigma 1.10}(CO_3)_{1.92}\cdot 3.68H_2O$, and $(Sr_{0.39}Ba_{0.87})_{\Sigma 1.26}(Ca_{0.34}La_{0.03}Ce_{0.06}Pr_{0.02}Nd_{0.14}Sm_{0.09}Eu_{0.02}Gd_{0.04})_{\Sigma 0.74}(CO_3)_{2.20}\cdot 10.00H_2O$. The analyses are for two distinct varieties, respectively: (1) pale green, transparent, colorless in thin section, optically biaxial negative, $\alpha = 1.556$, $\beta = 1.650$, $\gamma = 1.653$, $2V = 10–13°$; (2) yellow-brown, opaque, colorless in thin section, optically uniaxial, $\omega = 1.651$, $\epsilon = 1.556$. $H = 3–3.5$, no cleavage, fracture uneven. Powder X-ray data (114.6-mm camera, Cr$K\alpha$ radiation, NaCl standard) calculated assuming triclinic symmetry gave $a = 9.183$, $b = 9.182$, $c = 7.042$ Å, $\alpha = 102.52$, $\beta = 115.66$, $\gamma = 59.99°$, $V = 463.4$ $Å^3$. Diffraction lines (25 listed) corresponding to those given for mckelveyite-(Y) are 6.39(50,001), 4.49(90,$21\bar{1}$), 4.15(50,$12\bar{1}$), 3.313(40,121), 2.933(100 broad, 211), 2.655(80,$33\bar{1}$), 2.447(40 broad, $03\bar{1}$), 2.279(60 broad, $42\bar{1}$), 2.067(40,$24\bar{2}$), 2.031(70,$33\bar{3}$), 1.964(60 broad, $42\bar{3}$), and 1.724(50,$54\bar{2}$). The mineral occurs in solution cavities in carbonatite of the Vuoriyarvi massif, Kola Peninsula, Russia. Mckelveyite-(Y) and mckelveyite-(Nd) occur together, the former rarely and in platy aggregates, the latter more abundantly in single disk-shaped pseudorhombohedral crystals to 1 mm across or in parallel growths of crystals, both of which formed later than mckelveyite-(Y). Associated minerals are chalcopyrite, sphalerite, galena, pyrite, barite, strontianite, chlorite, ancylite, ewaldite, cordylite, carbonate apatite, alstonite, and carbocernaite.

Discussion. The H_2O contents were estimated by difference from 100% and are thus subject to very high uncertainties, particularly given the absence of independent CO_2 determinations and the difficulties involved in the microprobe analyses of REE. Consequently, the results presented here offer no evidence for a variable H_2O content in mckelveyite. Four of the five analyses suggest that a mckelveyite-(Y) and a mckelveyite-(Nd) could be distinguished, the latter of which would be a new mineral for a formula in which Na, Ca, and REE are isolated rather than grouped, as is done here. The second analysis for mckelveyite-(Nd) has a deficiency in large cations that is caused by the absence of Na and is not compensated by Ca or another constituent; moreover, REE + Ca $\ll$ Sr + Ba, in contrast to mckelveyite. **E.S.G.**

Neptunite

M. Kunz, T. Armbruster, G.A. Lager, A.J. Schulz, R.J. Goyette, W. Lottermoses, G. Amthauer (1991) Fe, Ti ordering and octahedral distortions in acentric neptunite: Temperature dependent X-ray and neutron structure refinements and Mössbauer spectroscopy. Phys. Chem. Minerals, 18, 199–213.

Single-crystal X-ray and neutron structural refinements of neptunite, $KNa_2Li(Fe,Mg,Mn)_2Ti_2Si_8O_{24}$, from San Benito County, California, show that the octahedrally coordinated metals (Ti,Fe,Mn,Mg) are ordered, thus leading to the monoclinic space group *Cc* rather than the previously assigned space group *C*2/*c*. **J.L.J.**

Spertiniite

H.R. Oswald, A. Reller, H.W. Schmalle, E. Dubler (1990) Structure of copper(II) hydroxide, $Cu(OH)_2$. Acta Crystallogr., C46, 2279–2284.

Single-crystal X-ray structure study ($R = 0.042$) of synthetic $Cu(OH)_2$, corresponding to the mineral spertiniite, showed that the mineral is orthorhombic, space group

Cmc2_1, rather than previously assigned space group *Cmcm*. **J.L.J.**

Wittite

N.N. Mozgova, Y. Moëlo, Yu.S. Borodaev, S.N. Nenasheva (1992) Wittite with Se-rich cosalite and bismuthinite from Nevskoe tin deposit (Magaden District, Russia). Mineral. Petrology, 46, 137–153.

Wittite from its second known occurrence, the Nevskoe Sn deposit, eastern Siberia, has (range in wt% for electron microprobe analyses) Pb 29–43, Bi 34–46, Se up to 16.5, Sb to 1.5, Ag to 1.3, and Cu to 0.2. After consideration of Se-S, and Bi + (Ag,Cu) → 2Pb substitutions, the general formula is $Pb_{11.61-2x}\square_{0.13}Ag_x(Bi_{14.26+x-y}Sb_y)(S_{1-z}Se_z)_{33}$, where x and $y \leq 0.86$ and $z \leq 0.45$. The microprobe data for wittite and cannizzarite indicate a continuous solid solution from Se-free cannizzarite to Se-rich wittite, always with Se/S ≤ 1. The results make questionable the validity of wittite as a separate species, but structural data are needed to confirm this. **J.L.J.**

Discredited Mineral

Kehoite

J.S. White, R.C. Erd (1992) Kehoite is *not* a valid species. Mineral. Mag., 56, 256–258.

Kehoite from the Merritt mine, Galena, Lawrence County, North Dakota, was originally described in the last century as a hydrated zinc aluminum phosphate. Reexamination of the type specimen by electron microprobe showed it to consist of quartz, sphalerite, gypsum, pyrite, and a finely divided unidentified Ca-Mg mineral. X-ray diffraction patterns confirmed the presence of quartz, sphalerite, and gypsum, matching well the previously published powder diffraction lines purported to be characteristic of kehoite; as well, the finely divided matrix was found to give a weak pattern close to that of woodhouseite $CaAl_3(PO_4)(SO_4)(OH)_6$. Thus, kehoite is a heterogeneous mixture of several phases.

Discussion. Kehoite has not been submitted to the CNMMN for official discreditation. **J.L.J.**