New Mineral Names*

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ALLORIITE*

R.K. Rastsvetaeva, A.G. Ivanova, N.V. Chukanov, and I.A. Verin (2007) Crystal structure of alloriite. Dokl. Akad. Nauk, 415(2), 242–246 (in Russian); Dokl. Earth Sci., 415, 815–819 (in English).

Single-crystal X-ray structure refinement of alloriite, a member of the cancrinite-sodalite group from the Sabatino volcanic complex, Latium, Italy, gives $a = 12.892(3)$, $c = 21.340(5)$ Å, space group $P31c$, $R_{aniso} = 0.052$ [3040 $F > 6\sigma(F)$, Mo$K\alpha$], empirical formula $Na_{18.4}K_6Ca_{4.8}[(Si_{6.6}Al_{5.4})_4O_{96}][SO_4]_{4.8}Cl_{0.8}(CO_3)_x(H_2O)_y$, crystal-chemical formula $\{Si_{26}Al_{22}O_{96}\}$ $\{(Na_{3.54}Ca_{0.46})$ $[(H_2O)_{3.54}(OH)_{0.46}]\}$ $\{(Na_{16.85}K_6Ca_{1.15})[(SO_4)_4(SO_3,CO_3)_2]\}$ $\{Ca_4[(OH)_{1.6}Cl_{0.4}]\}$ ($Z = 1$). Alloriite has the afghanite structure type, showing the same 8-layer ACACBCBC package, and alternating columns of cancrinite and liottite + cancrinite cages. Braces in the crystal-chemical formula, above, denote first the framework, then the column of cancrinite cages, and then the cancrinite and liottite cages in the mixed column. With the exception of only one site, Si and Al are ordered in the framework. The sites of intraframework cations such as Na, K, and Ca are commonly split and partially occupied. Instead of the –Ca–Cl–Ca–Cl– or –Ca–Cl–Ca–H$_2$O– chains of afghanite, alloriite has –Na–H$_2$O–Na–H$_2$O– chains; and instead of Ca$_4$Cl$_2$ or Ca$_4$(H$_2$O)$_2$ clusters, alloriite has Ca$_4$[(OH)$_{1.6}$Cl$_{0.4}$] clusters. Minor differences also exist in the anionic composition of the liottite cage. **T.S.E.**

CHLORO-POTASSICHASTINGSITE*

I.V. Pekov, N.V. Chukanov, M.E. Nefedova, D.Yu. Pushcharovskiy, and R.K. Rastsvetaeva (2005) Chloro-potassichastingsite $(K,Na)Ca_2Fe^{2+},Mg)_4Fe^{3+}[Si_6Al_2O_{22}](Cl,OH)_2$: the new name of revalidated dashkesanite. Zap. Ross. Mineral. Obshch., 134(6), 31–36 (in Russian, English abstract).

"Dashkesanite" was discovered by G.A. Krutov in 1936 and described as a chlorine-bearing clinoamphibole, but was subsequently discredited by the 1978 IMA Subcommittee on Amphiboles as a chlor-potassian variety of hastingsite. This new study of type "dashkesanite" shows the mineral to be a valid species, *chloro-potassichastingsite* by modern IMA regulations. Chloro-potassichastingsite comes from amphibole skarns in the northeast part of the Dashkesan cobalt-iron deposit, Caucasus Minors, Azerbaijan, where it can make up in excess of 95% of the skarn, the remainder consisting of quartz, chlorite, actinolite, apatite,

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epidote, magnetite, hematite, chalcopyrite, bornite, and cobaltite. Chloro-potassichastingsite is semi-transparent dark green with a greenish-gray streak and vitreous luster. The mineral is brittle with perfect {110} cleavage and stepped fracture. $H = 5$, mean VHN$_{20}$ = 839 kg/mm^2, $D_{obs} = 3.52(1)$, $D_{calc} = 3.53$ g/cm^3. Biaxial (–) and strongly pleochroic with $\alpha = 1.728(2)$ (pale orange-yellow), $\beta = 1.749(5)$ (dark blue-green), $\gamma = 1.751(2)$ (dark green-blue), $2V = 15(5)°$, positive sign of elongation, optic-axis dispersion $r > v$, orientation $Y = b$, $Z \wedge c = 11°$.

Analysis by electron microprobe, wet chemistry (Fe^{2+}:Fe^{3+}) and the Penfield method (H$_2$O) gave: Na$_2$O 1.07, K$_2$O 3.04, CaO 10.72, MgO 2.91, MnO 0.40, FeO 23.48, Fe$_2$O$_3$ 7.80, Al$_2$O$_3$ 11.13, SiO$_2$ 35.62, TiO$_2$ 0.43, F 0.14, Cl 4.68, H$_2$O$^+$ 0.54, O = (Cl,F)$_2$ –1.12, total 100.84. IR spectroscopy shows OH to be present but insignificant. On a basis of 24 (O, Cl, F, OH) the formula is $(K_{0.64}Na_{0.34})_{\Sigma0.98}Ca_{1.90}(Fe^{2+}_{3.25}Fe^{3+}_{0.97}Mg_{0.72}Mn_{0.06}Al_{0.06}Ti_{0.05})_{\Sigma5.11}(Si_{5.89}Al_{2.11})_{\Sigma8}O_{22}(Cl_{1.31}OH_{0.60}F_{0.07}O_{0.02})_{\Sigma2}$, or ideally $(K, Na)Ca_2(Fe^{2+}, Mg)_4Fe^{3+}[Si_6Al_2O_{22}](Cl, OH)_2$.

The strongest lines in the X-ray powder diffraction pattern are [d Å (I %,hkl)]: 8.53(100,110), 3.32(11,240), 3.16(51,310), 2.981(12,221), 2.839(18,330), 2.749(23,331,151), and 2.191(6,261). The observed intensities suffer somewhat from preferred orientation. Refinement of the powder data gives $a = 9.979$ (4), $b = 18.035$ (8), $c = 5.302$ (3) Å, $\beta = 104.71$ (4)°, space group $C2/m$, $Z = 2$. Structure refinement was carried out elsewhere (Rastsvetayeva et al. 1996, *Kristallografiya*, 41, 65–69), and confirms the basic features of $C/2m$ amphiboles. Neotype material has been deposited with the A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow (Systematic Collection, catalog no. 89293). **T.S.E.**

HEPHAISTOSITE*

I. Campostrini, F. Demartin, C.M. Grammaccioli, and P. Orlandi (2008) Hephaistosite, TlPb$_2$Cl$_5$, a new thallium mineral species from La Fossa crater, Vulcano, Aeolian Islands, Italy. Can. Mineral., 46, 701–708.

Hephaistosite was discovered on fragments of an altered breccia collected in a high temperature fumarole at the rim of the La Fossa crater. Associated minerals are bismuthinite (Bi$_2$S$_3$), cotunnite (PbCl$_2$), challacolloite (KPb$_2$ Cl$_5$), and pseudocotunnite (K$_2$PbCl$_4$). Hephaistosite occurs as aggregates of pale-yellow tabular crystals up to 0.1 mm in length. Refractive index (using the Brewster angle method) is 2.0(1). D_{calc} is 5.932 g/cm^3. No fluorescence was observed in ultraviolet light, the mineral is not hygroscopic.

Composition was determined by EDS (volatilization issues made WDS analyses impossible) with the average of 8 analyses

giving (in wt%): Tl 23.78, K 0.01, Pb 51.78, Cl 21.40, Br 1.34, F 0.17, for a total of 98.48. The empirical formula on the basis of eight apfu is $Tl_{0.94}Pb_{2.01}(Cl_{4.85}Br_{0.14}F_{0.07})_{\Sigma5.06}$.

Powder X-ray diffraction data were collected using a Rigaku D/MAX diffractometer and graphite monochromated Cu$K\alpha$ radiation. Hephaistosite is monoclinic, space group $P2_1/c$ with $a = 8.9477(6)$, $b = 7.9218(7)$, $c = 12.4955(5)$ Å, $\beta = 90.092(4)°$, $V = 885.70(7)$ Å^3, and $Z = 4$. This is in excellent agreement with synthetic $TlPb_2Cl_5$. The strongest six reflections in the X-ray powder-diffraction data [d_{obs} in Å ($I\%,hkl$)]are 3.696(100,013), 3.971(83,020), 2.109(45,402,215), 2.569(42,204), 1.848(41,142,026), and 2.851(38,213).

Crystal structures for two samples with significant K substitution for Tl were determined using a Bruker Apex II diffractometer with a CCD detector and Mo$K\alpha$ radiation; R_1 was 0.0275/0.0379 and wR_2 0.0664/0.0917 for the two crystals, respectively. The cell volume for the K-rich material is significantly smaller than that of the Tl-rich material. Hephaistosite is isostructural with challacolloite and intermediate members of the hephaistosite-challacolloite series are found in the fumarole. The name is for Hephaistos, the Greek god of fire. The holotype sample is held in the Reference Collection of Dipartimento di Chimica Strutturale e Stereochimica Inorganica of Università degli Studi di Milano (2006-2). **G.P.**

LABYRINTHITE*

A.P. Khomyakov, G.N. Nechelyustov, and 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, $\omega = 1.597(1)$, $\varepsilon = 1.601(1)$. Fluoresces bright violet under N_2 laser. 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 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$\underline{10}$), 3.550(39,220), 3.230(44,02$\underline{16}$), 3.173(34,12$\underline{14}$), 3.049(36,11$\underline{18}$), 2.977(100,13$\underline{10}$), 2.853(88,048), 2.685(38,140), and 2.605(36,03$\underline{18}$).

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 $(Na_{33.30}K_{1.45}Sr_{0.74})_{\Sigma35.49}(Ca_{11.77}Ce_{0.10})_{\Sigma11.87}$

$(Fe_{2.19}Mn_{0.87})_{\Sigma3.06}Zr_{5.94}$ $(Ti_{0.52}Si_{0.26})_{\Sigma0.78}Si_{51}O_{144.48}(OH)_{4.80}Cl_{2.95}F_{0.36}\cdot$ $3H_2O$ (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.**

MAGNESIOPASCOITE*

A.R. Kampf and I.M. Steele (2008) Magnesiopascoite, a new member of the pascoite group: description and crystal structure. Can. Mineral., 46, 679–686.

Magnesiopascoite occurs upon leaching and oxidation of vanadium oxides caused by groundwater in a post-mining environment. It forms tabular to equant to prismatic transparent adamantine crystals with a yellow streak. It is brittle and soft with a Mohs hardness of $2^1/_2$. It has no apparent twinning, but as a conchoidal fracture and a perfect cleavage on {001}. Electron microprobe analyses (average of 4 analyses) gave CaO 7.78, MgO 2.67, ZnO 0.23, CoO 0.05, V_2O_5 71.32, H_2O 21.94, sum 103.99 wt%, corresponding to $Ca_{1.77}(Mg_{0.85}Zn_{0.04}Co_{0.01})(H_2O)_{15.34}(H_3O)_{0.66}(V_{10}O_{28})$ based on V = 10 and O = 44 apfu and enough H for charge balance. Magnesiopascoite is biaxial (–), $\alpha = 1.769(3)$, $\beta = 1.802(3)$, $\gamma = 1.807(3)$, $2V_{meas} = 45(5)°$, and $2V_{calc} = 42°$. The observed dispersion is $r < v$, crossed. It is pleochroic orange to yellow. The mineral is slowly soluble in water and quickly soluble in HCl.

Based on single-crystal work done on a Bruker PLATFORM three-circle goniometer equipped with a CCD detector, magnesiopascoite is monoclinic $C2/m$ with refined unit-cell dimensions of $a = 19.8442(15)$, $b = 9.9353(8)$, $c = 10.7149(8)$ Å, $\beta = 120.305(1)°$, $V = 1823.9(2)$ Å^3, $Z = 2$, $D_{meas} = 2.43(2)$ g/cm^3, and $D_{calc} = 2.442$ g/cm^3. The crystal structure was refined to $R_1 = 2.27\%$ with $F_o > 4\sigma(F_o)$ for 2061 reflections. The strongest lines on the X-ray powder diffraction pattern (Gandolfi camera, 114.6 mm, Ni-filtered Cu$K\alpha$ radiation, 25 lines) include [d Å, ($I\%,hkl$)] 9.242(20,001), 8.872(30,$\overline{2}$01), 8.571(100,110,200), 7.270(40,$\overline{1}$11), 5.477(15,$\overline{3}$11), 4.590(15,$\overline{1}$12), 4.355(15,021,$\overline{2}$21), 2.813(15,222), 2.137(20,133,$\overline{9}$13). Magnesiopascoite is a pascoite-group mineral, a group that has a structure that consists of an anionic decavanadate $(V_{10}O_{28})^{-6}$ building blocks with interstitial hydrated cationic groups.

Magnesiopascoite is from the Blue Cap mine, near La Sal, San Juan County, Utah, U.S.A. The mineral was named as the Mg analogue of pascoite. Type material has been deposited at the Natural History Museum of Los Angles County (catalog nos. 58610 and 58611). **R.R.**

MARTYITE*

A.R. Kampf and I.M. Steele (2008) Martyite, a new mineral species related to volborthite: description and crystal structure. Can. Mineral., 46, 687–692.

Martyite was discovered in the Blue Cap mine, La Sal, San Juan County, Utah. Associated minerals are gypsum, rossite, pyrite, montroseite, and magnesiopascoite. Martyite, magnesiopascoite, and rossite are believed to have formed from post-mining leaching and oxidation of vanadium oxides by circulating groundwater.

Martyite occurs as thin flakes and plates with maximum dimensions of 1 mm and thicknesses up to 0.1 mm. The {100} form is common, with a less developed {110} form occasionally observed. The flakes and plates intergrow to form mats and rosettes. Thicker plates are red-orange while the thinnest flakes are bright yellow-orange.

Martyite has an adamantine luster with a pale yellow-orange streak. Thick plates are brittle with curved fractures, but thin flakes can be slightly flexible. Mohs hardness is 3. There is a perfect cleavage on {100} and a good one on {100}. The mineral is rapidly soluble in cold hydrochloric acid. D_{obs} and D_{calc} are 3.37(3) and 3.375 g/cm^3, respectively. It exhibits strong pleochroism with O (red-orange) $\gg$ E (yellow). It is optically uniaxial (+) with ω = 1.797(3) and ε = 1.806(3). The Dale-Gladstone index is 0.057 or good.

Chemical composition was determined with an electron microprobe (WDS). The average composition (n = 4) (wt% with ranges) is ZnO 46.93 (45.5–48.4), CoO 2.39 (1.26–2.97), CaO 0.58 (0.42–1.06), MgO 0.03 (0.01–0.03), V_2O_5 39.47 (38.5–40.0), H_2O 12.06 (from crystal structure), total 101.46%. This gives an empirical formula (based on V = 2 apfu and sufficient H for charge balance) of $(Zn_{2.66}Co_{0.15}Ca_{0.05})_{\Sigma 2.86}(V_2O_7)(OH)_{1.72} \cdot 2.23H_2O$.

Powder-diffraction data was collected using a 114.6 mm Gandolfi camera and Ni-filtered Cu$K\alpha$ radiation. The eight strongest lines [d in Å(I%,hkl)] are: 7.211(100,001), 2.968(50,012,102), 2.470(40,021,201), 2.628(35,200), 1.485(25,221,024,204), 4.252(20,011,101), 2.796(20,111), 1.773(20,023,203), and 1.513 (20,220).

Structure data was collected using a Bruker PLATFORM three circle goniometer with a 1k CCD detector. The structure was solved by direct methods, R_1 = 1.84% for 290 independent reflections, w$R2$ = 4.81%, GooF = 0.721. Martyite is hexagonal, $P\bar{3}m1$, a = 6.0818(4), c = 7.1793(10) Å, V = 229.97(4) Å^3, Z = 1, identical to synthetic $Zn_3(V_2O_7)(OH)_2 \cdot 2H_2O$. The structure of martyite consists of edge-sharing Zn-O octahedra forming sheets parallel to (001) linked in the c direction by V_2O_7 groups (two tetrahedra sharing one corner). Open space in this framework is occupied by H_2O molecules. This structure is identical to volborthite if hydrogen atoms are neglected. The monoclinic symmetry of volborthite is the result of the Jahn-Teller distortion of one of its Cu-O octahedra.

The mineral is named for Joe Marty for his contributions to mineralogy. Two cotype samples are in the collection of the Los Angeles County Natural History Museum (58610 and 58611). **G.P.**

NIELSENITE*

A.M. Macdonald, L.J. Cabri, N.S. Rudashevsky, C.J. Stanley, V.N. Rudashevsky, and K.C. Ross (2008) Nielsenite, PdCu$_3$, a new platinum-group intermetallic mineral species from the Skaergaard intrusion. Greenland, Can. Mineral., 46, 709–716.

Nielsenite was found as irregular droplet-shaped grains (average 16 μm in diameter) in a heavy mineral concentrate from a tholeiitic gabbro from the Skaergaard inclusion. It occurs in composite globules composed mainly of bornite-chalcocite, bornite with trace Ni-Co and Zn sulfides. Platinum group minerals found with nielsenite include skaergaardite, keithconnite, vasilite, zvyagintsevite, (Cu,Pd,Au), (Pd,Cu,Sn), and (Pt,Fe,Cu,Pd) alloys, and unnamed phases Au$_3$Cu and PdAuCu. The main minerals enclosing these globules include plagioclase, clinopyroxene, orthopyroxene, ilmenite, titanian magnetite, fayalite with accessory chlorite-group minerals, ferrosaponite, a member of the annite–phlogopite series, hornblende, actinolite, epidote-group minerals, calcite, ankerite, apatite, and baddeleyite. Nielsenite is steel-gray, with a metallic luster, a black streak and sectile tenacity. It is anhedral with no observed cleavage or fracture. It is non-pleochroic with no internal reflections, it is creamy white in reflected light with reflectance values (in %) in air (in oil) of: 57.6 (47.5) at 470 nm, 60.85 (50.8) at 546 nm, 62.8 (53.0) at 589 nm, and 66.7 (57.5) at 650 nm.

The chemical composition was determined using EDS with the average (and range) for 11 analyses giving (in wt%): Pd 29.86 (21.7–36.3), Pt 3.08 (n.d.–12.1), Au 3.70 (n.d.–18.4), Cu 61.96 (54.3–68.4), Fe 0.59 (n.d.–0.80), Pb 0.17 (n.d.–1.9), total 99.36%. The empirical formula for the average composition is $(Pd_{0.862}Au_{0.058}Pt_{0.049}Fe_{0.028}Pb_{0.003})(Cu_{2.996}Fe_{0.004})_{\Sigma 3}$ on the basis of 4 apfu.

Powder diffraction data was collected using a 114.6 mm Debye-Scherrer camera and Ni-filtered Cu$K\alpha$ radiation. The X-ray powder data was indexed using space group $P4mm$ based on good agreement between nielsenite and the calculated pattern for a synthetic PdCu$_3$. Nielsenite is tetragonal with a = 3.7125(8), c = 25.62(1) Å, V = 353.2(1) Å^3 for Z = 4. The strongest six lines on the X-ray powder-diffraction pattern [d in Å(I%,hkl)] are: 2.137(100,117), 1.8596(70,200), 1.8337(40,00$\underline{14}$), 1.3126(60,220), 1.1188(55,317), and 1.0663 (30,22$\underline{14}$). The authors attempted to study nielsenite using single-crystal methods, but reflections were found to be weak and diffuse, probably due to Pd-Cu disorder.

The authors suggest that the morphology of sulfide globules and the enclosed PGM indicate formation as immiscible melts and that nielsenite forms at temperatures at of below 508 °C based on the temperature of formation of the synthetic analog.

Nielsenite is named for Troels F.D. Nielsen, a geologist with the Geological Survey of Denmark and Greenland. Type material is held in the collection of the Geologisk Museum, Copenhagen K, Denmark (catalog number 2008.1). **G.P.**

PATTERSONITE*

U. Kolitsh, H.-J. Bernhardt, W. Krause, and G. Blass (2008) Pattersonite, PbFe$_3$(PO$_4$)$_2$(OH)$_4$[(H$_2$O)$_{0.5}$(OH)$_{0.5}$]$_2$, a new supergene phosphate mineral: description and crystal structure. Eur. J. Mineral., 20, 281–288.

Pattersonite can be considered a polymorph of kintoreite, PbFe$_3$(PO$_4$)$_2$(OH,H$_2$O)$_6$, ideally PbFe$_3$(PO$_4$)$_2$(OH)$_5$ (H$_2$O), a Pb-

Fe^{3+}-phosphate end-member in the alunite supergroup (rhombohedral). Pattersonite was found in a single, head-sized boulder collected in 1986 on the dumps of the Grube Vereinigung, near Eisenbach, about 5 km N of Bad Camberg, Taunus, Hesse, Germany. Pattersonite was found almost exclusively accompanied by yellow crusts and brown acute rhombohedra of kintoreite (possibly with small SO$_4$ content) on a matrix of mamillary goethite. Very rarely, white pyromorphite is also present on the samples.

The mineral is triclinic, space group $P\bar{1}$ (No. 2), with $a = 5.309(1)$, $b = 7.211(1)$, $c = 7.349(1)$ Å, $\alpha = 87.74(3)$, $\beta = 86.38(3)$, $\gamma = 71.40(3)°$, $V = 266.06(7)$ Å^3 (single-crystal data), and $Z = 1$. Strongest lines in the X-ray powder diffraction pattern are [d in Å ($I\%$, hkl)]: 4.848(100,110), 6.839(64,0$\bar{1}$0), 3.547(57,1$\bar{1}$0), 3.417(52,0$\bar{2}$0), 3.022(51,112), 3.667(47,00$\bar{2}$), 2.8339(45,11$\bar{2}$). The refined powder diffraction unit-cell parameters, $a = 5.307(1)$, $b = 7.209(1)$, $c = 7.349(1)$ Å, $\alpha = 87.75(2)$, $\beta = 86.36(2)$, $\gamma = 71.42(1)°$, $V = 265.9(1)$ Å^3, are in excellent agreement with those obtained from the single-crystal study. The unique crystal structure consists of an interrupted three-dimensional framework based on intersecting zigzag chains of corner-sharing FeO$_6$ octahedra, linked by PO$_4$ tetrahedra. The [8]-coordinated Pb atom is located within elliptical [100] channels. The asymmetric unit contains one unique Pb, three Fe, one P, seven O {two of which represent OH groups and one a mixed [(H$_2$O)$_{0.5}$(OH)$_{0.5}$] ligand with a calculated bond-valence sum of 0.75 valence units} and 3.5 H atoms. The coordination environment of the Pb^{2+} cation can be described as a monoclinically distorted cuboid; the lone electron pair on the cation is not stereochemically active.

The chemical composition of pattersonite was determined by a combination of quantitative electron microprobe analysis and crystal structure determination. The empirical formula Pb$_{1.00}$Fe$_{3.02}$(PO$_4$)$_{1.98}$(OH)$_{5.12}$(H$_2$O)$_{0.94}$ is based on six cations. The infrared spectrum shows bands (strong ones are italic; b = broad) due to OH stretching vibrations (at 3547, *3526*, 3291 b cm^{-1}), H-O-H bending vibrations of water molecules (~1610 b cm^{-1}) and vibrations of the PO$_4$ tetrahedra (ν1 and ν3: *1084* (slightly asymmetric), *1046*, 996, *973*, 927 cm^{-1}). The region below 650 cm^{-1} comprises partially overlapped bands assigned to the ν4 (and ν2) vibrations of the PO$_4$ tetrahedra, vibrations of the Fe- and Pb-centered polyhedra, and lattice modes (636, 571, 523, 504, 460, 407, ~377, 360, 325, ~296, ~273, 259 cm^{-1}).

Pattersonite is translucent, with a very pale yellow streak and adamantine luster. It is brittle, shows one poor cleavage of unknown orientation, conchoidal fracture, a Mohs hardness of 4½ (based on measured Vickers microindentation hardness VHN$_{25}$ = 530(80) kg/mm^2, from six individual measurements), and has $D_{meas} > 4.04$, $D_{calc} = 4.17$ g/cm^3 (from crystal-structure solution). Optically, it is biaxial negative, with $\alpha = 1.86(1)$, $\beta = 1.917$ (calc), $\gamma = 1.93(1)$, $2V\alpha = 50(5)°$ (indices measured on grain mounts with Cargille liquids; $2V$ derived from extinction measurements using a spindle stage). Dispersion is very strong ($r > v$) and the pleochroism is weak, X = nearly colorless to very pale yellow, Y = pale yellow to yellow, Z = yellow to dark yellow (depending on grain size), with absorption $Z > Y > X$. Orientation (polar coordinates in terms of ϕ and ρ based on (010) = 0°/90°) is X (−113°/85°); Y (155°/70°); Z (−10°/21°). Pattersonite is non-fluorescent and insoluble in cold 1:1 HCl.

The mineral and its name have been approved by the IMA

Commission on New Minerals and Mineral Names prior to publication (IMA 2005-049). The name honors the innovative crystallographer Arthur Lindo Patterson (1902–1966), who developed a method employing a Fourier series to generate a three-dimensional function, the now well-known "Patterson function" in crystal-structure determination. The type specimen has been deposited in the collection of the Natural History Museum, Vienna, Austria. **K.T.T.**

SANTAROSAITE*

J. Schlüter, D. Pohl, and U. Golla-Schindler (2008) Santarosaite, CuB$_2$O$_4$, a new mineral with disordered structure from the Santa Rosa mine, Atacama desert, Chile. Neus Jb. Mineral. Abh., 185, 27–32.

Santarosaite is a new mineral described from the oxidation zone of the polymetallic (silver, copper, lead) Santa Rosa mine, located in the Atacama desert of Northern Chile, 15 km SE of the port of Iquique. The mineral occurs in vivid blue globules (up to 60 µm in size) comprised of tiny (1 µm thick) leaf-like crystals. It is associated with green atacamite, yellow to orange wulfenite and anhydrite. Santarosaite has a pale blue streak, is not fluorescent, is soluble in HCl, and has a calculated density of 3.96 g/cm^3. It was not possible to measure the refractive indices of santarosaite—a calculated index using kc and D_{calc} gave 1.753. The mineral is not pleochroic.

The chemical composition of santarosaite was determined by a combination of electron microprobe (WDS), EELS, and LA-ICP-MS, with Raman micro-spectroscopy and ATR FTIR used to determine the presence or absence of H$_2$O, OH, CO$_2$ or CO$_3$, none of which were detected. The average composition of santarosaite (15 analyses by EMPA, 2 analyses by EELS) is CuO 43.24, PbO 4.48, CaO 0.97, B$_2$O$_3$ 45.44, total 94.13 wt%, corresponding to an empirical formula based on four anions of (Cu$_{0.86}$Pb$_{0.03}$Ca$_{0.03}$)B$_{2.06}$O$_4$, and a simplified formula of CuB$_2$O$_4$. No other elements were detected using the various methods. The ideal composition of santarosaite is CuO 53.33, B$_2$O$_3$ 46.67, total 100 wt%.

A single-crystal X-ray study of santarosaite was not possible due to the size of the crystals. A powder X-ray diffraction pattern was obtained using a Philips X'pert powder diffractometer (Cu$K\alpha$ radiation) and includes the following lines [d_{obs} in Å ($I\%$,hkl)] 3.797(100,211), 3.638(47,310), 3.167(10,301), 2.876(17,400), 2.775(35,321), 2.658(15,112), 2.572(26,420), 2.528(13,202), 2.501(26,411), 1.974(11,530), 1.853(10,103), 1.822(21,620), 1.793(20,611), 1.761(11,512) and 1.710(15,541). The measured powder X-ray diffraction pattern of santarosaite matches perfectly with synthetic copper metaborate, suggesting that the two phases are isostructural. A Rietveld refinement was used to determine the unit-cell parameters ($R_p = 4.13$, $R_{wp} = 5.23$, $S = 1.41$, $R_{Bragg} = 14.9$ for a mixture of 83.93 wt% santarosaite and 14.07 wt% quartz). Santarosaite is tetragonal, $I\bar{4}2d$, $a = 11.517(8)$, $c = 5.632(6)$ Å, $V = 747(1)$ Å^3, $Z = 12$. Substitution of Pb and Ca into the structure is suggested to be the result of a coupled substitution: (Pb,Ca) + 2□ ↔ 2Cu + O^{2-}, accounting for the structural disorder and displacement of cations that must take place in order to accommodate Pb and Ca in the Cu site.

The mineral (IMA no. 2007-013) is named for the Santa Rosa mine, a polymetallic vein deposit in the Atacama desert mined

primarily for silver, copper, and lead. Type material has been deposited in the collection of the Mineralogical Museum of the University of Hamburg, Germany.

Discussion: The authors suggest that the low analytical total (94.13 wt%) of the chemical composition is the result of structural features (vacancies), or the very small size of the crystals, and not due to analytical error. However, it must be noted that the presence of vacancies does not lower an analytical total achieved by EMPA methods. **P.C.P.**

Seifertite*

A. El Goresy, P. Dera, T.G. Sharp, C.T. Prewitt, M. Chen, L. Dubrovinsky, B. Wopenka, N.Z. Boctor, and R.J. Hemley (2008) Seifertite, a dense orthorhombic polymorph of silica from the Martian meteorites Shergotty and Zagami. Eur. J. Mineral., 20, 523–528.

An orthorhombic silica polymorph denser than stishovite was found in Shergotty with the scrutinyite (α-PbO$_2$) type structure. This mineral was found as lamellae occurring together with dense silica glass lamellae in composite silica grains in the heavily shocked Martian meteorite Shergotty. Shergotty is a basaltic achondrite that fell on August 25, 1865 in Bihar State in India. The main mass of 3600 g is preserved at the Museum of the Geological Survey in Calcutta, India. The meteorite consists of 70% pyroxene and 24% glass with labradorite composition or "maskelynite." Minor constituents are titanomagnetite, ilmenite, pyrrhotite, and silica. Silica grains, up to 900 μm in size, are usually enclosed in maskelynite and rarely border pyroxene. Rare shock melted mesostasis pockets with much smaller prismatic silica grains are also encountered. The mineral is also intergrown in some grains with minor stishovite and a new unnamed monoclinic dense silica polymorph with a ZrO$_2$-type structure. It is inferred that seifertite was formed by shock-induced solid-state transformation of either tridymite or cristobalite on Mars at an estimated minimum equilibrium shock pressure in excess of 35 GPa. Seifertite has also been found in the Martian shergottite Zagami and is a minor constituent in other Martian shergottites. Electron-microprobe analyses (EMPA) with a defocused beam on the widest seifertite and glass lamellae, respectively, showed almost pure SiO$_2$.

The crystal structure of seifertite was determined on two separate grains independently extracted and investigated by TEM and powder X-ray diffraction. Rietveld refinement of the latter definitively established the structure as that of scrutinyite, α-PbO$_2$, with unit-cell parameters $a = 4.097(1)$, $b = 5.0462(9)$, $c = 4.4946(8)$ Å, and space group $Pbcn$, or $Pb2n$. The crystal structure like stishovite or the CaCl$_2$-type modifications contains silicon in distorted octahedra, but with kinked chains of SiO$_6$ octahedra.

Its description as a new mineral was submitted to the Commission on New Minerals and Mineral Names, International Mineralogical Association, and approved with the mineral name seifertite. The name honors Friedrich A. Seifert (b. 1941), founding Director of the Bayerische Geoinstitut, Universität Bayreuth, Germany, for his important contributions to high-pressure geoscience.

Discussion: This mineral had been described in previous manuscripts (Sharp et al. 1999; Dera et al. 2002; El Goresy et al. 2004) but there had not been an application to the CNMMN for approval as a valid species. **K.T.T.**

Skorpionite*

W. Krause, H. Effenberger, H.-J. Bernhardt, and O. Medenbach (2008) Skorpionite, Ca$_3$Zn$_2$(PO$_4$)$_2$CO$_3$(OH)$_2$·H$_2$O, a new mineral from Namibia: description and crystal structure. Eur. J. Mineral., 20, 271–280.

Skorpionite is a secondary mineral discovered from the Skorpion zinc mine in south-western Namibia, approximately 40 km northwest of the Orange River and some 20 km northwest of the Rosh Pinah mine, Lüderitz district, Karas region. Associated minerals are tarbuttite, hydrozincite, and gypsum.

Single-crystal X-ray investigations show skorpionite to be monoclinic, $C2/c$, with unit-cell parameters $a = 19.045(3)$, $b = 9.320(2)$, $c = 6.525(1)$ Å, $\beta = 92.73(2)°$, $V = 1156.9(4)$ Å^3, $Z = 4$. Unit-cell parameters of skorpionite refined from the X-ray powder data for a monoclinic cell are $a = 19.042(2)$, $b = 9.309(1)$, $c = 6.519(1)$ Å, $\beta = 92.72(1)°$, $V = 1154.3(2)$ Å^3, which is in perfect agreement with the data obtained from the crystal structure determination.

Mean of 17 sets of microprobe analyses gave CaO 30.89, ZnO 28.83, P$_2$O$_5$ 25.49, CO$_2$ (calc) 7.96, H$_2$O (calc) 6.52, total 99.69 wt%. The empirical formula (based on 14 oxygen atoms pfu) is Ca$_{3.05}$Zn$_{1.96}$(PO$_4$)$_{1.99}$(CO$_3$)$_{1.00}$(OH)$_{2.06}$·0.98H$_2$O. The simplified formula is Ca$_3$Zn$_2$(PO$_4$)$_2$CO$_3$(OH)$_2$·H$_2$O, which requires: CaO 30.42, ZnO 29.43, P$_2$O$_5$ 25.67, CO$_2$ 7.96, H$_2$O 6.52, Total 100.00 wt%. The presence of hydroxyl groups, molecular water, and of carbonate were confirmed by Fourier-transform infrared (FTIR) and laser-Raman spectra. The IR spectrum shows a broad absorption band of weak intensity between 3450 and 3100 cm^{-1} due to the stretching vibration of hydroxyl groups and the water molecules. There is a medium absorption at 1638 cm^{-1} typical for the bending mode of molecular water. Strong absorption bands at 1459 and 1367 cm^{-1} are due to the carbonate group. Very strong absorptions at 1095, 1044, 1024 cm^{-1}, and several medium-to-strong absorptions in the range of 900 to 400 cm^{-1} are mainly due to the phosphate group. There is a strong and broad Raman absorption due to hydroxyl groups between 3770 and 3100 cm^{-1} with a maximum at 3566 cm^{-1}. The absorption of molecular water is at 1633 cm^{-1}, in perfect agreement with the IR data. Medium to weak absorptions at 1505 and 1398 cm^{-1} are due to the carbonate group. There are two very strong and sharp absorptions at 1075 and 972 cm^{-1} due to phosphate and additional medium absorptions at 1102, 1054, 1016, 702, 639, 575, 468, 423, 384, 322, 276, and 237 cm^{-1}.

The atomic arrangement can be described topologically as an alternate stacking of neutrally charged [Ca2$_2$Zn$_2$(OH)$_2$(PO$_4$)$_2$]^0 and [Ca$_1$(CO$_3$)(H$_2$O)]^0 layers parallel to (100), that are linked by hydrogen bonds and by Ca-O bonds. They are linked by the hydrogen bond formed by the hydroxyl group and by Ca-O bonds. ZnO$_4$ and PO$_4$ tetrahedra are corner linked to corrugated sheets. **K.T.T.**

Struvite-(K)*

S. Graeser, W. Postl, H.-P. Bojar, P. Berlepsch, T. Armbruster, T. Raber, K. Ettinger, and F. Walter (2008) Struvite-(K), KMgPO$_4$·6H$_2$O, the potassium equivalent of struvite—a new mineral. Eur. J. Mineral., 20, 629–633.

The new mineral struvite-(K) is the natural potassium equivalent to struvite NH$_4$MgPO$_4$·6H$_2$O. It was discovered independently

at two different localities: (1) at the famous sulfosalt locality Lengenbach in Binntal, Switzerland, and (2) Rossblei, Schladminger Tauern, Styria, Austria, an abandoned galena mine.

(1) *Lengenbach*: at the moment only one sample containing struvite-(K) is known from this locality. The sample is found in a dolomitic rock of Triassic age with small cavities, which contain mainly dolomite crystals, some quartz, frequent realgar, and various As-sulfosalts like jordanite, dufrénoysite, rathite, tennantite. Struvite-(K) has grown on sulfosalt minerals (rathite) and on dolomite crystals as well. Under the polarizing microscope, struvite-(K) is colorless, has low refraction indices and small birefringence. The optic normal lying parallel to the needle axis, the mineral shows (±) elongation, depending on the position of the needles. Dispersion of the optic axes is visible (with $r < v$). Calculated density is 1.864 g/cm^3. Hardness not determined. Cleavage not visible, presumably absent; conchoidal fracture; streak white.

Optically, the mineral is biaxial positive, with $2V_Z$ = large, α = 1.490(2), β = 1.493(2) (for 589 nm), γ could not be measured, the optic axes plane (OAP) is perpendicular to the needle axis, therefore β parallels the crystallographic a axis.

The Lengenbach sample was primarily tested by qualitative EDS analyses on an SEM, yielding K, Mg, and P as major components, with traces of Sb, Fe, and Cu. With the result of the single-crystal study as a presumably new K-Mg-P-mineral with struvite structure, quantitative EMP analyses were indispensable for a further study. Unfortunately, any attempts to produce proper preparations for EMP analyses from the completely transparent minute crystals failed. The only solution to this problem was the complete structure determination, including a refinement of K vs. NH$_4$. Single-crystal study showed the mineral to be orthorhombic, with space group $Pmn2_1$ (from analogy to struvite), a = 6.903(3), b = 6.174(2), c = 11.146(3) Å, V = 475.0(2) Å^3 (refined from powder data).

(2) *Rossblei*, Schladming: Struvite-(K) occurs as fine-grained intergrowth with newberyite in flat tabular pseudomorphs of an unknown precursor. The crystals of struvite-(K) are xenomorphic and up to 20 μm in size, whereas newberyite is hypidiomorphic up to 100 μm. Both form flat tabular dirty-white aggregates. No quantitative data were achieved, due to instability of these phosphates under the micro-beam. Cell parameters refined from the powder data, after deduction of newberyite lines, are a = 6.878(1), b = 6.161(1), c = 11.100(1) Å, V = 470.41(9) Å^3. No additional physical, optical, morphological data could be derived due to the close intergrowth of the two minerals.

The Lengenbach sample, with a more complete data collection, has been designated as the holotype sample for the new species struvite-(K), KMgPO$_4$·H$_2$O. Type material is deposited (under number S176) in the Natural History Museum of Basel, Switzerland. **K.T.T.**

SURKHOBITE*

R.K. Rastsvetaeva, E.M. Eskova, D. Dusmatov, N.V. Chukanov, and F. Schneider (2008) Surkhobite: revalidation and redefinition with the new formula, $(Ba,K)_2CaNa(Mn,Fe^{2+},Fe^{3+})_8Ti_4$ $(Si_2O_7)_4O_4(F,OH,O)_6$. Eur. J. Mineral., 20, 289–295.

Surkhobite (named for discovery locality in the basin of the Surkhob river) was found by V.D. Dusmatov in 1976 in an alka-line pegmatite at the massif Darai-Pioz, Tajikistan. Surkhobite was approved in 2002 as a new mineral (IMA no. 2002-037). This proposal was based only on an electron microprobe analysis carried out for the holotype specimen of surkhobite, which demonstrated predominance of Na. According to the results of voting on the latter proposal, surkhobite was discredited with the conclusion: "Name and species surkhobite are discredited because the species corresponds to jinshajiangite and this species has priority" (decision 06 − E of the IMA CNMMN). In this study, it is redefined with a new formula and revalidated with the original name (IMA 07-A).

The crystal structure was refined on a single crystal to R = 0.043 with 3686 independent reflections ($F > 2\sigma$). Surkhobite is monoclinic, $C2$, a = 10.723(1), b = 13.826(2), c = 20.791(4) Å, β = 95.00(1)°. The strongest lines of the powder diffraction pattern [d_{obs} in Å ($I\%,hkl$)] are: 10.39(20,002), 3.454(100,006), 3.186(15,321), 2.862(15,225), 2.592(70,008), 2.074(40,048). The chemical composition is (electron microprobe combined with Mössbauer data, wt%): Na$_2$O 2.27, K$_2$O 1.87, CaO 2.53, SrO 0.26, BaO 11.16, MgO 0.13, MnO 16.32, FeO 13.92, Fe$_2$O$_3$ 2.11, Al$_2$O$_3$ 0.02, SiO$_2$ 27.17, TiO$_2$ 16.14, Nb$_2$O$_5$ 2.14, ZrO$_2$ 0.34, F 2.94, H$_2$O (by Penfield method) 1.17, –O = F$_2$ –1.24, total 99.25. The empirical formula is (Z = 2): Na$_{2.60}$K$_{1.41}$Ca$_{1.60}$Sr$_{0.09}$Ba$_{2.58}$ (Mn$_{8.17}$Fe$^{2+}_{6.88}$ Fe$^{3+}_{0.94}$Mg$_{0.115}$Al$_{0.01}$)$_{\Sigma16.115}$ (Ti$_{7.17}$Nb$_{0.57}$Zr$_{0.10}$)$_{\Sigma7.84}$Si$_{16.06}$H$_{4.61}$F$_{5.49}$O$_{70.51}$. The simplified formula, taking into account the crystal structure, is (Z = 2): KBa$_3$Ca$_2$Na$_2$(Mn, Fe^{2+},Fe^{3+})$_{16}$Ti$_8$ (Si$_2$O$_7$)$_8$O$_8$(OH)$_4$(F,O,OH)$_8$.

The mineral is optically biaxial, negative, β = 1.858(10), γ = 1.888(10); $2V$ = 65(5)°; α = 1.790 (calculated from $2V$). Optical orientation: $X = b$, $Z \wedge a = 34°$. Dispersion is strong, $r < v$. Pleochroism: Y (orange) > Z (bright yellow) $\geq X$ (yellow). Micro-twinning on (001) is observed. Density measured by volumetric method is D_{meas} = 3.84(10) g/cm^3; D_{calc} = 3.98 g/cm^3. Surkhobite is translucent, brownish-red, luster vitreous, streak white, cleavage perfect on {001}; hardness is anisotropic: the minimum value $H1$ = 250 kg/mm^2, the maximum value $H2$ = 482 kg/mm^2; Mohs' hardness is 4.5.

A crystal has been deposited as holotype material in the Fersman Mineralogical Museum, RAS, Moscow. **K.T.T.**

THERMESSAITE*

F. Demartin, C.M. Grammaccioli, I. Campostrini, and P. Orlandi (2008) Thermessaite, K$_2$[AlF$_3$|SO$_4$], a new ino-aluminofluoride–sulfate from La Fossa crater, Vulcano, Aeolian Islands, Italy. Can. Mineral., 46, 693–700.

Thermessaite was found as small colorless to white prismatic crystals in an active fumarole on the rim of La Fossa crater. The crystals are up to 0.25 mm in length and are associated with alunite, sassolite, anhydrite, and metavoltine. Thermessaite is prismatic with the dominant forms being {110} and the pinacoid {100} and is terminated by the bipyramid {111}. It is colorless to white with a white streak, a vitreous luster, and brittle tenacity. No cleavage or partings were observed. Fluorescence was not observed at any ultraviolet radiation. Mean index of refraction is 1.445 with D_{calc} and D_{obs} 2.790 and 2.77(2) g/cm^3, respectively.

The chemical composition was determined using WDS. The average (and range) of seven analyses is K$_2$O 36.19 (35.61–36.55), Al$_2$O$_3$ 20.42 (19.99–20.95), SO$_3$ 28.74 (28.17–29.26),

F 22.89 (21.52–23.77) leading to an empirical formula of $K_{2.02}[Al_{1.05}F_{3.17}S_{0.94}O_{3.83}]$.

Powder diffraction data were collected using a Rigaku DMAX-II diffractometer with CuKα radiation. The six strongest lines [d in Å ($I\%, hkl$)] are: 2.983(100,311), 2.702(82,130), 6.631(70,110), 1.712(58,530), 2.208(30,330), and 3.317(28,310).

Single-crystal data was collected from a $0.2 \times 0.9 \times 0.08$ mm crystal fragment using a Bruker Apex II diffractometer and MoKα radiation, R_1 was 0.0286 for 685 reflections with $I > 2\sigma(I)$. Thermessaite is orthorhombic, space group $Pbcn$, $a = 10.810(2)$, $b = 8.336(2)$, $c = 6.822(1)$ Å, $V = 614.8(2)$ Å^3, $Z = 4$. The structure of thermessaite consists of AlF_4O_2 octahedra that are linked to other AlF_4O_2 octahedra by two of the F-bearing vertices to form chains along [001]. The oxygen bearing vertices are shared with SO_4 tetrahedra. K^+ ions are coordinated by five oxygen and four fluorine atoms to form irregular polyhedra.

The name is for Thermessa an ancient Greek name for the island of Vulcano. Type material is held in the Reference Collection of Dipartimento di Chimica Strutturale e Stereochimica Inorganica of Università degli Studi di Milano (2007-2). **G.P.**

URAMARSITE*

G.A. Sidorenko, N.V. Chukanov, N.I. Chistyakova, G.I. Bebeshko, A.E. Zadov, and I.S. Naumova (2007) Uramarsite $(NH_4,H_3O)_2$ $(UO_2)_2(AsO_4,PO_4)_2\cdot6H_2O$: a new mineral of the metaautunite group. Dokl. Akad. Nauk 415, 804–808 (in Russian); Dokl. Earth Sci. 415A, 965–969 (in English).

Uramarsite was discovered in the supergene zone of the Bota-Burum U-Mo deposit, south of Alakol' Lake, southwestern Balkhash area, Southern Kazakhstan Region, Kazakhstan. The mineral is a hypergene phase that formed via oxidation of pitchblende-sulfide mineralization in highly fractured zones in hydrothermally altered porphyritic felsites. It is associated with calcite, arsenopyrite, pyrite, galena, chistyakovaite, natrouranospinite, scorodite, arseniosiderite, mansfieldite, metazeunerite, and trögerite. Uramarsite and chistyakovaite form blocky pseudocrystals with sharp orthogonal boundaries between the two phases. Uramarsite forms imperfect, platy crystallites to 2 mm, films, and, less often, flattened square crystals to 0.1 mm in size. Forms are {001} (major) and {010} (minor). Color transparent pale green, luster vitreous to dull (films), green fluorescence (UV). Brittle with perfect {001}, imperfect {010} cleavage; stepped fracture. H = 2.5, $D_{obs} = 3.22$, $D_{calc} = 3.286$ g/cm^3. Colorless in thin section, anomalously biaxial (–), α = 1.562(2), β ≈ γ = 1.593(2), $2V < 5°$, no dispersion, optical orientation $X = c$, $Y \approx b$, straight extinction.

Analysis by SAED and ionometric methods gave: Na_2O 0.3, UO_3 61.8, As_2O_5 15.0, P_2O_5 5.9, $(NH_4)_2O$ 3.2, total 86.2%. The presence of water and hydronium was established by IR spectroscopy; H_2O was estimated by difference as 13.8%. Dissolution with HCl indicates that no CO_2 is evolved. The formula, based on 2(As,P), is $[(NH_4)_{1.15}(H_3O)_{0.72}Na_{0.09}]_{\Sigma1.96}(UO_2)_{2.02}[(As_{0.61}P_{0.39})O_4]_2\cdot6.1H_2O$, or ideally $(NH_4,H_3O)_2(UO_2)_2[(As,P)O_4]_2\cdot6H_2O$. The strongest lines in the X-ray powder diffraction pattern (CuKα, diffractometry) are [d Å($I\%,hkl$)]: 9.27(100,001), 4.58(25,002), 3.86(20,012), 2.80(13,013), 2.28(20,004), 1.823(8,133), and 1.713(7,141).

Refinement of the powder data gives $a = 7.19(1)$, $c = 9.15(2)$

Å, space group $P4/nmm$, $Z = 1$; however, the possibility exists that the c cell edge may be twice this value. Poor crystal quality precluded single-crystal studies. The difference between X-ray and optical properties is attributed to microstrain associated with dehydration. The mineral is a member of the meta-autunite group, more specifically the arsenate analog of uramphite. The holotype sample is deposited with the Fedorovskiy All-Russia Research Institute of Mineral Resources (catalog no. 350/59/zel).

Discussion: Many of the properties such as streak, transparency, pleochroism, and some measures of precision are not given here, despite that they were reported in the IMA submission. Furthermore, there are *major* discrepancies between the methods and conditions for chemical analysis reported to the IMA and those published in the paper, despite the identity of the analytical results. **T.S.E.**

NEW DATA

ALKALI AMPHIBOLES

F.C. Hawthorne, R. Oberti, A. Zanetti, and V.K. Nayak (2008) The crystal chemistry of alkali amphiboles from the Kajlidongri manganese mine, India. Can Mineral., 46, 455–466.

The authors present structural, crystallographic, and compositional data from eight amphiboles from the Kajlidongri mine in India. The amphiboles (magnesioriebeckite, richterite, potassian ferrian richterite, ferrian richterite, and magnesio-arfedsonite) were selected to investigate the incorporation of Li into the C site and do not contain significant Mn or Ti and have OH + F = 2 apfu.

Chemical compositions of the amphiboles were determined using WDS for major and minor elements and ion-microprobe for Li. Compositional and formula data are provided for the eight samples.

Structures were determined using MoKα radiation data and all samples refined to R-values of 1 to 2%. Tables of atom positions, anisotropic placement coefficients, crystal data, and interatomic distances are provided. The T sites in these samples are almost entirely filled by Si. The M2 site is mainly filled by trivalent Fe with lesser amounts of Mg and Al. The M1 and M3 sites are predominantly filled by Mg. Li in the C-group is almost entirely in the M3 site. M1 is dominated by Mg but also contains a higher atomic number component that, based on scattering factors, is Mn. A small excess of C-group cations requires assignment of a C-group cation to the M4 site. Some evidence suggests that there is some preference for Li over Mg in the M4 site. Strong correlations between Li and F (slope 0.5) suggest that Li is locally associated with F at each O3 site. The authors suggest that under the conditions present at Kajlidongri, F cannot enter the O3 site in the absence of Li. This suggests a linked transport of Li and F in the hydrothermal fluid. **G.P.**

BARYTOLAMPROPHYLLITE*

E. Sokolova and F. Cámara (2008) From structure topology to chemical composition: III. Titanium silicates: the crystal chemistry of barytolamprophyllite. Can. Mineral, 46, 403–412.

The authors set out to resolve ambiguities in the chemical formulae and structures of minerals in the lamprophyllite group of

minerals, especially with regard to barytolamprophyllite. Samples of barytolamprophyllite used in this work were obtained from Mt. Yuksporr, Khibna alkaline massif, Kola Peninsula, Russia.

The chemical composition was determined by WDS. Averaging of 10 point analyses gives the following composition SiO_2 29.31, Al_2O_3 0.16, Nb_2O_5 0.11, TiO_2 28.39, Fe_2O_3 0.49, FeO 2.66, MnO 2.42, MgO 0.26, CaO 0.88, SrO 4.11, BaO 16.37, K_2O 3.52, Na_2O 7.90, F 1.69, H_2O 0.77, O = F 0.71, giving a total of 98.33 [H_2O (and presumably Fe_2O_3) is calculated on the basis of structure]. This composition gives an empirical formula of $(Ba_{0.88}K_{0.61}Sr_{0.33}Ca_{0.05}\square_{0.13})_{\Sigma2.00}$ $(Na_{2.09}Fe^{2+}_{0.30}Mn^{2+}_{0.28}Ca_{0.08}$ $Mg_{0.05}\square_{0.20})_{\Sigma3.00}$ $(Ti_{2.91}Fe^{3+}_{0.05}Al_{0.03}Nb_{0.01})_{\Sigma3.00}(Si_2O_7)_2O_2[F_{0.73}$ $(OH)_{0.70}O_{0.57}]_{\Sigma2.00}$ for Z = 2 and 4 Si per formula unit. The ideal formula is $(BaK)Na_3Ti_3$ $(Si_2O_7)_2$ O_2 $(OH)_2$.

The crystal structure of barytolamprophyllite was refined using a $0.03 \times 0.10 \times 0.16$ mm crystal on a Bruker Smart Apex diffractometer with graphite filtered MoKα radiation; $R_1 = 2.82\%$ on the basis of 1175 unique reflections with $F > 4\sigma(F)$, w$R2 = 7.44\%$, GooF = 1.12. Barytolamprophyllite has space group $C2/m$ with $a = 19.8971(7)$, $b = 7.1165(3)$, $c = 5.4108(2)$ Å, $\beta = 96.676(2)°$, $V = 760.96(3)$ Å^3, Z = 2. The calculated density is 3.521 g/cm^3.

Structurally barytolamprophyllite is composed of two blocks. The first (titanium silicate = TS) block consists of sheets of alternating heteropolyhedral and octahedral sites. This block contains a tetrahedrally coordinated Si site, two Ti dominant sites (one five-coordinated and one six-coordinated) and two six-coordinated Na sites. The other block (intermediate = I) contains mainly Ba and K in tenfold coordination. These two blocks (TS and I) alternate along a. This structure is topologically identical with those of lamprophyllite and nablamprophyllite. The authors provide an ideal formula of $(A^{2+}A^+)$ Na_3Ti_3 $(Si_2O_7)_2$ O_2 $(OH)_2$ for the lamprophyllite group, with A^{2+} = Sr, Ba, or Ca and A^+ being Na or K. **G.P.**

CERVANDONITE-(CE)*

F. Demartin, C.M. Gramacioli, and S. Graeser (2008) The crystal structure of cervandonite-(Ce), an interesting example of As^{3+} → Si diadochy. Can. Mineral., 46, 423–430.

Initial studies of this mineral were hampered by scarcity of material for structural studies. The current work is based on studies carried out using a $0.08 \times 0.03 \times 0.02$ mm crystal fragment from Pizzo Cervandone (Scherbadung) in the Central Alps. Data were collected using a BRUKER Apex II diffractometer with a 2K CCD detector and MoKα radiation. Cervandonite-(Ce) has a monoclinic supercell with Z = 6. The authors also refined the structure as trigonal subcell using 441 reflections with $I > 2\sigma(I)$, $R_1 = 0.380$, w$R_2 = 0.0887$. This trigonal subcell has space group $R3m$ with $a = 6.508(1)$, $c = 18.520(3)$ Å, $V = 679.4(2)$ Å^3, and Z = 3. Crystal-structure constraints lead the authors to suggest that arsenic is As^{3+} and not As^{5+} as previously believed. Arsenic anions in the form of $[AsO_3^{3-}]$ (and minor OH$^-$) replace sorosilicate anions $(Si_2O_7^{6-})$. The authors provide a revised formula to account for this substitution; $(Ce,Nd,La)(Fe^{3+},Fe^{2+},Ti^{4+},Al)_3O_2$ $(Si_2O_7)_{1-x+y}(AsO_3)_{1+x-y}(OH)_{3x-3y}$ with x = 0.47 and y = 0.31 for the material studied. **G.P.**

FOOTEMINEITE*

R.K. Rastsvetaeva, N.V. Chukanov, I.A. Verin, and D. Atencio (2007) The crystal structure of footemineite. Dokl. Akad.

Nauk, 416(1), 103–106 (in Russian); Dokl. Earth Sci., 416, 1053–1056 (in English).

A single-crystal X-ray structure refinement of footemineite from the Foote mine gives $a = 6.788(2)$, $b = 9.972(3)$, $c = 10.014(2)$ Å, $\alpha = 73.84(2)$, $\beta = 85.34(2)$, $\gamma = 87.44(2)°$, space group $P\bar{1}$, $R_{aniso} = 0.035$ [$1273 F > 2\sigma(F)$, MoKα], crystal-chemical formula $(Ca_{1.92}Sr_{0.08})_{\Sigma2}$ $[(Mn,Fe)_{0.9}\square_{0.1}]_{\Sigma1}(\square_{0.78}Li_{0.17}Mg_{0.05})_{\Sigma1}$ Mn_2 Mn_2 Be_4 $[(P_{0.97}Si_{0.03})O_4]_6$ $(OH)_4$ $(H_2O,OH)_2(H_2O)_4$. Footemineite is the manganese-rich member of the roscherite group and is isostructural with atencioite. The lower symmetry of atencioite and footemineite (triclinic) vs. other members of the group (monoclinic) is due to ordering of (Mn, Fe) and vacancies.

Discussion: The location of the Foote mine is erroneously given as California (actually in the Kings Mountain pegmatite district, Cleveland County, North Carolina). **T.S.E.**

GAUDEFROYITE*

S.M. Antao and I. Hassan (2008) Gaudefroyite, $Ca_8Mn_6^{3+}$ $[(BO_3)_6(CO_3)_2O_6]$: high-temperature crystal structure. Can. Mineral., 46, 183–193.

Synchrotron techniques were used to study the crystal structure of gaudefroyite at ambient and high temperatures. The sample used in this study was from the Wessels Mine, Kalihari manganese field, South Africa. The 25 °C structure was refined using high-resolution powder X-ray diffraction at the Advanced Photon Source, Argonne National Laboratory using a wavelength of 0.40167(2) Å. The high temperature data were collected at the National Synchrotron Light Source at Brookhaven National Laboratory using in situ radiation at a wavelength of 0.9212(4) Å at a temperature interval of 17 °C to a maximum of 845 °C. Differential scanning calorimetry and thermogravimetry were carried out on 1.56 mg of sample at a heating rate of 10 °C/min from 25 to 1200 °C.

The unit-cell parameters increase linearly from $a = 10.60791(2)$, $c = 5.88603(1)$ Å, and $V = 573.605(2)$ Å^3 at 25 °C to $a = 10.67467(9)$, $c = 5.92984(8)$ Å, and $V = 585.17(1)$ Å^3 at 486 °C; a volume increase of 2.2(2)%. Above 486 °C, the appearance of additional peaks in the diffractograms indicated the appearance of an additional phase in the samples. Based on the positions of the new peaks, the authors suggest that above 486 °C hausmannite is exsolved. Results from differential scanning calorimetry eliminate the possibility of a phase change. An XRD pattern obtained from a cooled sample shows that the change is not reversible.

Examination of changes in interatomic distances with temperature show that only Ca-O distances increase with temperature, specifically the Ca1-O3 distance. The six Ca1-O3 bonds in the structure are not aligned in any particular plane and thus are responsible for the isotropic expansion of the structure. **G.P.**

LAPHAMITE*

L. Bindi, P. Bonazzi, and P.G. Spry (2008) Effects of sulfur-for-selenium substitution on the structure of laphamite, $As_2(Se,S)_3$. Can. Mineral., 46, 269–274.

The crystal structures and chemistry of two samples of laphamite from the type locality (a coal-waste fire in the Western

Middle Anthracite field, Northumberland County, Pennsylvania) in order to study structural changes associated with elemental substitution. WDS analyses showed the two samples (LAP1 and LAP2) were essentially homogeneous and have the following compositions (wt% with ranges) As 43.05 (42.35–43.51), Sb 0.94 (0.82–1.05), S 5.76 (5.16–5.98), Se 50.38 (49.47–52.13), Total 100.13 (99.33–101.63) (LAP1) and As 43.48 (42.52–44.19), Sb 0.33 (0.20–0.60), S 6.47 (5.00–7.26), Se 50.51 (49.23–52.24), Total 100.79 wt% (100.26–101.72) (LAP2) leading to empirical formulae of $(As_{1.97}Sb_{0.03})(Se_{2.28}S_{0.64}As_{0.08})$ and $(As_{1.99}Sb_{0.01})$ $(Se_{2.25}S_{0.71}As_{0.04})$, respectively.

Structure refinements were carried out using graphite monochromated Mo$K\alpha$ on an automated diffractometer. Unit-cell parameters are $a = 11.891(7)$, $b = 9.742(5)$, $c = 4.274(3)$ Å, $\beta = 90.03(4)°$, $V = 495.1(5)$ Å^3 (LAP1) and $a = 11.934(4)$, $b = 9.804(4)$, $c = 4.268(2)$ Å, $\beta = 90.32(4)°$, $V = 499.4(4)$ Å^3 (LAP1). The refinement yielded R factors of 5.46% and 5.15% for LAP1 an LAP2 respectively, with LAP1 requiring correction for twinning. The crystal structure of laphamite consists of AsX_3 pyramids linked by shared X atoms to create As_2X_3 layers parallel to (010). This structure is topologically identical to orpiment. Site occupancy factors for both crystals show that Se is disordered over the three anion positions (X1, X2, X3) with a strong preference for X3 and a lesser preference for X2. Cell parameters a and b increase linearly with increasing Se/S + Se while c remains constant. No correlation between β and Se/S + Se content was discerned. **G.P.**

SADANAGAITE* AND POTASSIC-FERRISADANAGAITE*

F.C. Hawthorne and G.E. Harlow (2008) The crystal chemistry of Al-rich amphiboles: sadanagaite and potassic-ferrisadanagaite. Can. Mineral., 46, 151–162.

Magnesiosadanagaite from Mogok, Myanmar, and potassic-ferrisadanagaite from The Ilmen alkali massif, South Urals Russia, were structurally and chemically characterized to study the stereochemical characteristics of Al-rich amphiboles.

Chemical composition was determined using electron microprobe. The composition of the magnesiosadanagaite in wt% is SiO_2 38.42, Al_2O_3 22.20, TiO_2 1.48, Cr_2O_3 0.60, Fe_2O_3 0.0, FeO 1.92, MnO 0.0, ZnO 0.0, MgO 15.81, CaO 12.77, Na_2O 3.14, K_2O 0.92, F 0.94, H_2O 1.66 (H_2O and Fe_2O_3 calculated from structure) leading to an empirical formula of $(Na_{0.82} K_{0.17})(Ca_{1.95} Na_{0.05})(Mg_{3.36}Fe_{0.23}^{2+}$ $Al_{1.20}Cr_{0.07}^{3+}Ti_{0.16}^{4+})(Si_{5.47}Al_{2.53})O_{22}[(OH)_{1.58}F_{0.42}]$. The composition of the potassic-ferrisadanagaite is SiO_2 33.02, Al_2O_3 18.61, TiO_2 1.78, Cr_2O_3 0.00, Fe_2O_3, 8.95, FeO 15.96, MnO 1.92, ZnO 0.19, MgO 2.35, CaO 10.09, Na_2O 1.91, K_2O 3.04, F 060, H_2O 1.60 (H_2O calculated from structure, Fe_2O_3 from Mössbauer) leading to an empirical formula of $(Na_{0.31} K_{0.62})(Ca_{1.72} Na_{0.28})(Mg_{0.56}Fe_{2.12}^{2+}Mn_{0.26}^{2+}$ $Zn_{0.02}Al_{0.72}Fe_{1.07}^{3+}Ti_{0.21}^{4+}) (Si_{5.24} Al_{2.76}) O_{22} [(OH)_{1.70} F_{0.30}]$.

Structural data was collected using graphite-collimated Mo$K\alpha$ radiation. Both samples are monoclinic, space group C2/m and Z =2. The magnesiosadanagaite has cell parameters $a = 9.857(2)$, b 17.899(4), $c = 5.318(1)$ Å, $\beta = 105.36(1)°$, $V = 904.74(8)$ Å^3, and potassic-ferrisadanagaite has cell parameters $a = 9.9257(4)$, $b = 18.0917(7)$, $c = 5.3709(2)$ Å, $\beta = 105.19(1)°$, $V = 930.75(2)$ Å^3.

Site population assignments show that tetrahedrally coordinated aluminum is strongly ordered into the T1 site but significant aluminum is still found in T2. Ti^{4+} is strongly to fully ordered at the M1 site. In magnesiosadanagaite the A2 site is occupied by Na and the A(m) site is occupied by (Na,K) in potassic-ferrisadanagaite A2 is occupied by Na and A(m) by K. The authors show that there is strong short-range order of cations and anions with respect to the A, M4, and O3 sites. **G.P.**

SZAIBÉLYITE*

J.D. Grice (2008) Szaibélyite: crystal-structure analysis and hydrogen bonding. Can. Mineral., 46, 671–677.

The crystal structure for szaibélyite ideally $MgBO_2(OH)$, was first described from Kitai, China. Prior studies describing the structure were incomplete due to the lack of crystals suitable for single-crystal work. The find of suitable crystals in Upper Halite member of the Windsor Group evaporates from the Potash Corporation of Saskatchewan (New Brunswick Division) mine at Penobsquis, Kings County, New Brunswick, allowed a full crystal structure study. Crystals from this locality are clear, colorless, or white fibrous and elongated on the c axis. They sometimes exhibit a bladed habit flattened on (100). Crystals are not twinned, but frequently show subparallel growth along (001). Microprobe analyses on the szaibélyite from Penobsquis gave an average of MgO 47.92, FeO 0.74, MnO 0.04, B_2O_3 41.77, H_2O 10.81, sum 101.18 wt%, corresponding to $(Mg_{0.99}Fe_{0.01})B_2H_1O_3$ based on 3 anions. X-ray intensity data was collected using a fully automated Siemens P4 circle diffractometer with a CCD detector on a 0.20 × 0.12 × 0.08 mm crystal. Szaibélyite is monoclinic, $P2_1/a$, $a = 12.586(1)$, $b = 10.415(1)$, $c = 3.1340(3)$ Å, $\beta = 95.923(2)°$, $V = 408.6(1)$ Å^3, $Z = 8$, $R_{index} = 3.1$ for 1191 unique reflections. In the crystal structure, $[MgO_6]$ octahedra create sheets that are cross-linked by borate polyanions and H-bonding that is reflected by the (100) flattened habit and cleavage. Szaibélyite contains the fundamental building block (FBB) 2Δ: 2Δ and is isostructural with sussexite. Other borate minerals with the same FBB are kurchatovite, clinokurchatovite, and suanite. **R.R.**

WILHELMRAMSAYITE*

I.V. Pekov, N.V. Chukanov, M.M. Boldyreva, and V.T. Dubinchuk (2006) Wilhelmramsayite, $Cu_3FeS_3 \cdot 2H_2O$, a new mineral from Khibiny massif, Kola Peninsula. Zap. Ross. Mineral. Obshch., 135(1), 38–48 (in Russian, English abstract).

Wilhelmramsayite occurs in the core zone of an ultra-agpaitic pegmatite generally of potassium feldspar–nepheline–sodalite–alkali amphibole–pyroxene composition on Koashva Mt. in the Khibiny massif. The core zone is mineralogically diverse, but generally consists of aegirine, microcline, sodalite, natrolite, pectolite, and villaumite ± natrite, thermonatrite, and lomonosovite. Wilhelmramsayite is particularly concentrated in dense aggregates of villaumite, pectolite, and rasvumite, and can also be associated with lamprophyllite, chkalovite, vitusite-(Ce), and sphalerite. It shows minor replacement by covellite, and is anticipated to have formed as a late hydrothermal phase. The mineral forms {001} rectangular platy to tabular crystals to 6 × 5 × 1 mm and is found both as singles and in aggregates. Most individuals are bent or split. It also occurs sandwiched with lomonosovite and/or lamprophyllite in massive coarse-grained villaumite. It is opaque, metallic luster, dark lead-gray on fresh surfaces but rapidly turns iron-black in air.

Perfect {001} cleavage; flexible yet inelastic; leaflike fracture. It visually resembles nagyagite. Mohs hardness 2.5; microindentation hardness 116 kg/mm^2 (10 g load); D_{meas} 2.75(10), D_{calc} 2.84 g/cm^3; weakly ferromagnetic. Bluish gray in reflected light with weak bireflectance (bluish gray to gray with bluish tints); weakly anisotropic; no internal reflections; normal dispersion. Reflectance data are (λ nm: $R_1 - R_2$%): (400: 14.95–17.45), (470: 13.70–16.35), (546: 11.35–14.00), (589: 10.00–12.55), (650: 8.65–11.00), (700: 8.00–9.80).

Unit-cell parameters are $a = 5.147(2)$, $b = 7.289(2)$, $c = 5.889$ Å (powder camera; Fe radiation); space group $Pmmm$ (electron diffraction). The strongest maxima in the powder XRD pattern are [d Å (I%,hkl)]: 5.12(40,100), 4.21(40,110), 2.727(50,012), 2.292(50,022), 1.985(30,221,003), 1.897(70,013), 1.828(50,103,040).

Chemical composition by electron microprobe and TGA is: Na 0.12, K 0.27, Tl 0.44, Cu 48.52, Fe 15.20, S 25.20, H$_2$O$^+$ 9.28, H$_2$O$^-$ 1.43, total 100.46 wt%, giving the empirical formula Cu$_{2.91}$Fe$_{1.04}$S$_{3.00}$(K$_{0.03}$Na$_{0.02}$Tl$_{0.01}$)$_{\Sigma 0.06}$·1.97(H$_2$O), or ideally Cu$_3$FeS$_3$·2H$_2$O ($Z = 1$). It is anticipated that wilhelmramsayite formed from an anhydrous, (Na,K)-richer precursor via exchange of Na and K for H$_2$O.

The name honors Finnish geologist Wilhelm Ramsay, who did the first detailed study of the Khibiny-Lovozero alkaline complexes. Type material is deposited with the Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow (catalog no. 3218/1). **T.S.E.**

ERRATUM

The authors wish to apologize for the spelling error in the abstract of the minerals hingganite-(Ce) and hingganite-(Y) (*Am. Mineral.*, 93, 1668). The following is the corrected abstract.

HINGGANITE-(CE), HINGGANITE-(Y)*

R. Miyawaki, S. Matsubara, K. Yokoyama, and A. Okamoto (2007) Hingganite-(Ce) and hingganite-(Y) from Tahara, Hirukawa-mura, Gifu Prefecture, Japan: The description on a new mineral species of the Ce-analogue of hingganite-(Y) with a refinement of the crystal structure of hingganite-(Y). J. Mineral. Petrol. Sciences, 102, 1–7.

Hingganite-(Ce) was unofficially described in 1987 by Miyawaki et al. (*J. Mineral. Soc. Japan*, 18, 17–30). This recent paper represents the formal, approved description of hingganite-(Ce) from a pegmatite at Tahara, Hirukawa-mura, Gifu Prefecture, Japan, along with a crystal structure refinement of hingganite-(Y) from the same locality. Hingganite-(Ce) occurs as rims on euhedral, prismatic crystals of hingganite-(Y) from 1 to 5 mm in length. It is associated with quartz, potassium feldspar, albite, zinnwaldite, cassiterite, stokesite, fluorite, chlorite, titanite, and an undetermined Ca-rich mineral related to hingganite-(Y). Hingganite-(Ce) is transparent, pale tan, has a vitreous luster, a white streak, and a Mohs hardness of 5–6. It does not fluoresce in either short or long wave UV light. Cleavage was not observed,

and the density could not be determined due to the small crystal size ($D_{calc} = 4.28$ g/cm^3). Hingganite-(Ce) is biaxial (+), $2V > 75°$, $\alpha = 1.745(5)$, $\gamma = 1.770(5)$.

Chemical analyses of hingganite-(Ce) and hingganite-(Y) were performed by electron microprobe, with Be and B contents confirmed by SIMS. The average composition of hingganite-(Ce) is La$_2$O$_3$ 11.11, Ce$_2$O$_3$ 28.32, Pr$_2$O$_3$ 2.11, Nd$_2$O$_3$ 4.70, Sm$_2$O$_3$ 0.39, Gd$_2$O$_3$ 0.08, Tb$_2$O$_3$ trace, Dy$_2$O$_3$ 0.05, Ho$_2$O$_3$ trace, Er$_2$O$_3$ trace, Tm$_2$O$_3$ trace, Yb$_2$O$_3$ trace, Lu$_2$O$_3$ trace, Y$_2$O$_3$ 0.72, CaO 7.07, FeO 3.61, SiO$_2$ 25.47, BeO$_{calc}$ 10.60, H$_2$O$_{calc}$ 2.88, total 97.10 wt%, corresponding to (Ce$_{0.82}$La$_{0.32}$Nd$_{0.13}$Pr$_{0.06}$Y$_{0.03}$Sm$_{0.01}$Gd$_{0.002}$Dy$_{0.001}$Ca$_{0.60}$)$_{S1.97}$Fe$_{0.24}$Be$_{2.02}$Si$_{2.02}$O$_{8.20}$(OH)$_{1.52}$, based on 4(REE + Ca + Si). The simplified formula of hingganite-(Ce) is (Ce,Ca)$_2$($\square$,Fe)Be$_2$Si$_2$O$_8$[(OH),O]$_2$, and the ideal formula is Ce$_2$$\square$Be$_2Si_2O_8(OH)_2$ or CeBeSiO$_4$(OH), which requires Ce$_2$O$_3$ 63.56, SiO$_2$ 23.27, BeO 9.69, H$_2$O 3.49, total 100 wt%. The average composition of hingganite-(Y) (grain used for single-crystal X-ray refinement) is La$_2$O$_3$ 0.28, Ce$_2$O$_3$ 1.58, Pr$_2$O$_3$ 0.50, Nd$_2$O$_3$ 2.48, Sm$_2$O$_3$ 1.26, Gd$_2$O$_3$ 2.56, Tb$_2$O$_3$ 0.36, Dy$_2$O$_3$ 2.51, Ho$_2$O$_3$ 1.30, Er$_2$O$_3$ 1.85, Tm$_2$O$_3$ 0.41, Yb$_2$O$_3$ 2.20, Lu$_2$O$_3$ 0.95, Y$_2$O$_3$ 31.11, CaO 3.57, FeO 3.70, SiO$_2$ 28.27, BeO$_{calc}$ 11.77, H$_2$O$_{calc}$ 3.17, total 99.83 wt%, corresponding to (Y$_{1.21}$Ca$_{0.28}$Nd$_{0.06}$Gd$_{0.06}$Dy$_{0.06}$Yb$_{0.05}$Er$_{0.04}$Ce$_{0.04}$Sm$_{0.03}$Ho$_{0.03}$Lu$_{0.02}$Pr$_{0.01}$Tm$_{0.01}$Tb$_{0.01}$La$_{0.01}$)$_{\Sigma1.92}$Fe$_{0.23}$Be$_{2.07}$Si$_{2.07}$O$_{8.19}$(OH)$_{1.55}$, based on 4(REE + Ca + Si).

A single-crystal X-ray refinement of hingganite-(Ce) was not possible due to the small size of the crystals. Powder X-ray diffraction data were obtained (114.6 mm Gandolfi camera and imaging plate, Cu$K\alpha$ radiation) and unit-cell parameters determined using the Rietveld method with positional and isotropic displacement parameters fixed to those of hingganite-(Y). Hingganite-(Ce) is isostructural with hingganite-(Y), monoclinic, $P2_1/a$, Z = 2, $a = 9.8973(11)$, $b = 7.6282(8)$, $c = 4.7505(6)$ Å, $\beta = 90.416(8)°$, $V = 358.64(7)$ Å^3. The strongest lines on the powder X-ray diffraction pattern include [d (I%,hkl)]: 6.06(42,110), 3.74(37,$\bar{1}$11), 3.56(28,120), 3.44(34,$\bar{2}$01), 3.13(86,$\bar{2}$11), 2.98(26,021), 2.85(100,$\bar{1}$21), 2.56(46,$\bar{2}$21), 2.21(33,112), 1.976(30,$\bar{1}$22), 1.771(28,041), and 1.663(21,241). The structure of hingganite-(Y) was determined by single-crystal X-ray diffraction: $0.10 \times 0.07 \times 0.05$ mm^3 crystal, R_1 [$I > 2\sigma(I)$] 0.0329, R_1 (all 1299 unique reflections) 0.0448, R_{int} 0.0330, GoF 1.151, $a = 9.8830(16)$, $b = 7.6091(9)$, $c = 4.7423(9)$ Å, $\beta = 90.342(14)°$, $V = 356.62$ Å^3. The strongest lines on the powder X-ray diffraction pattern (114.6 mm Gandolfi camera and imaging plate, Cu$K\alpha$ radiation) include [d in Å (I%,hkl)]: 6.01(33,110), 3.73(32,$\bar{1}$11), 3.55(22,120), 3.43(35,$\bar{2}$01), 3.12(100,$\bar{2}$11), 2.97(28,021), 2.84(84,$\bar{1}$21), 2.55(70,$\bar{2}$21), 1.972(35,$\bar{1}$22), 1.768(15,041), and 1.662(23,241).

Hingganite-(Ce) is isostructural with hingganite-(Y). The substitution of Ca for Ce in hingganite-(Ce) suggests a solid solution with calciogadolinite or datolite. REE distribution patterns in single, zoned grains of hingganite-(Ce) and hingganite-(Y) show varying Ho anomalies. Type material of hingganite-(Ce) (IMA no. 2004-004) has been deposited at the National Science Museum, Tokyo, Japan (NSM-M28552).

Comment: No detailed description of either the geology of the type locality or the structure is given. **P.C.P.**