

NEW MINERAL NAMES*

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Ashoverite*

A.M. Clark, E.E. Fejer, G. Cressey, P.C. Tandy (1988) Ashoverite, a new mineral, and other polymorphs of $Zn(OH)_2$ from Milltown, Ashover, Derbyshire. *Mineral. Mag.*, 52, 699–702.

Specimens sent to the British Museum (Natural History), London, from the oxidized vein that contains sweetite [tetragonal $Zn(OH)_2$] were examined further and were found to contain three additional polymorphs of $Zn(OH)_2$, one of which constitutes the second occurrence of wülfingite. As well, γ - $Zn(OH)_2$ is present as a white radiating acicular mineral identified by the match of its X-ray powder pattern with that of the synthetic phase. The last polymorph (ashoverite) occurs on colorless fluorite as groups of square plates about 0.5 mm across. The mineral is colorless and translucent, progressing to milky grain centers; dull to vitreous luster, white streak, fluoresces bluish-white in short-wave ultraviolet light, perfect {001} cleavage, $D_{meas} = 3.3 \text{ g/cm}^3$ by Berman balance, 3.44 g/cm^3 from the chemical analysis. Optically uniaxial positive, $\omega = 1.629(2)$, $\epsilon = 1.639(2)$. Single-crystal X-ray study indicated tetragonal symmetry, space group $I4_1/amd$, $I4/mc$, or $I\bar{4}2d$, $a = 6.825(2)$, $c = 33.36(4) \text{ \AA}$. Strongest lines of the powder pattern (114.6-mm Debye-Scherrer camera, Fe radiation) are 3.332(11,202), 3.031(13,211), 2.902(100,206), 1.819(33,2.2.12,325,3.0.11), 1.702(21,400,3.0.13,1.0.19), 1.470(19,426), and 1.0063(13,2.6.12). Electron-microprobe analysis gave ZnO 84.46, PbO 2.06, CdO 0.71, CaO 0.15, H₂O 14.9 (by CHN analyzer), sum 102.28 wt%. Enhanced cation values result from water loss under the electron beam. Recalculation on the basis of 2(O, OH) gave $(Zn_{1.182}Pb_{0.011}Cd_{0.006}Ca_{0.003})_{\Sigma 1.202}O_{0.404}(OH)_{1.596}$. The oxidized vein containing the $Zn(OH)_2$ polymorphs is in a limestone quarry at Milltown, near Ashover, Derbyshire, England. The new name is for the locality. J.L.J.

Chestermanite*

R.C. Erd, E.E. Foord (1988) Chestermanite, a new member of the ludwigite-pinakolite group from Fresno County, California. *Can. Mineral.*, 26, 911–916.

Electron-microprobe analysis gave Al₂O₃ 5.3, Fe₂O₃ 16.0, Sb₂O₃ 10.3, TiO₂ 0.8, MgO 48.0, MnO 0.1, CaO 0.1, B₂O₃

(calculated for B = 1) 18.22, F 0.1, O \equiv F 0.04, sum 98.88 wt%, corresponding to $Mg_2(Fe_{0.38}^{3+}Mg_{0.28}Al_{0.20}Sb_{0.12}^{5+}Ti_{0.02})_{\Sigma 1.00}BO_3(O_{1.99}F_{0.01})_{\Sigma 2.00}$, ideally $Mg_2(Fe^{3+}, Mg, Al, Sb^{5+})BO_3O_2$. The mineral is typically fibrous to asbestiform, grayish-green, streak pale grayish-green, vitreous to silky luster, H = 6, uneven to conchoidal fracture, nonfluorescent, nonmagnetic. Crystals are up to $2 \times 0.33 \times 0.06 \text{ mm}$, elongate [001] and flattened {010}, diamond-shaped in cross section, finely striated parallel to [011], showing {110}, {210}, {010}, and less commonly {100}, {130}, {120}, {230}, {540}, and {320}. $D_{meas} = 3.72(2)$ as determined in heavy liquids, $D_{calc} = 3.650 \text{ g/cm}^3$ with $Z = 16$. Optically biaxial positive, $\alpha = 1.753(2)$, $\beta = 1.763(2)$, $\gamma = 1.791(2)$ for Na light, $2V_Z = 63^\circ(\text{calc.})$; pleochroism $X = \text{dark greenish-blue}$, $Y = \text{green}$, $Z = \text{pale yellowish-brown}$. X-ray single-crystal study gave orthorhombic symmetry, space group $Pnmm$ or $Pnn2$, $a = 18.535(3)$, $b = 12.273(1)$, $c = 6.043(1) \text{ \AA}$. Strongest lines of the powder diffractometer pattern for $CuK\alpha$ radiation are 5.114(100) (220), 2.746(34)(340,530), 2.559(91)(440), 2.475(19)(412), 2.169(57)(450,820), 1.9975(32)(260), and 1.5300(19) (1.0.22). Isostructural with orthopinakolite.

Chestermanite is named for Charles W. Chesterman, retired geologist of the California Division of Mines and Geology. The mineral occurs in a brucite marble body in the Twin Lakes region, Fresno County, California, in association with calcite, ludwigite, fluoborite, wightmanite, two undescribed borate minerals, spinel, brucite, safflorite, and löllingite. Type material is in the U.S. National Museum, Washington, D.C. J.L.J.

Cliachite

L.D. Arkhipova, S.A. Galiy, O.D. Korsakov, V.V. Kruglyakov, A.I. Marushkin (1987) First cliachite find in Pacific pelagic sediments. *Doklady Akad. Nauk SSSR*, 296(3), 701–704 (in Russian, English translation available).

Dredged sandy to silty sediments from the northeastern Pacific at $15^\circ 30' \text{ N}$, $125^\circ 45' \text{ W}$ contain irregular grains of size 0.08 to 0.2 mm, for which an electron-microprobe analysis gave 48 wt% Al₂O₃ (range 44 to 54 wt%) and only traces of other elements. Dehydration under the electron beam is indicated by desiccation cracks. The grains are mainly colorless, less commonly pinkish orange, grayish pink, or creamy; glassy to brilliant luster, transparent to milky white, color-zoned, H = <3, brittle, breaks into

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

sharp fragments, some with conchoidal fracture, readily soluble in dilute HCl. Optically isotropic, $n = 1.462$ to 1.531 . Amorphous to X-rays. On heating to 800°C forms $\kappa\text{-Al}_2\text{O}_3$.

Discussion. Revival of an unnecessary name for amorphous aluminum hydroxide. **J.L.J.**

Fe-shafranovskite

V.V. Korovyshkin, A.P. Khomyakov, O.V. Anikeeva (1987) Mössbauer study of the valence forms of iron in Fe-shafranovskite $\text{H}_6(\text{Na}, \text{K})_6(\text{Fe}, \text{Mn})_3\text{Si}_9\text{O}_{27} \cdot 3\text{H}_2\text{O}$. *Novye Dannye Mineral.*, 34, 149–152 (in Russian).

A wet-chemical analysis (three given) of shafranovskite samples from the type locality at Khibiny, Kola Peninsula, USSR, gave SiO_2 49.70, TiO_2 0.17, Al_2O_3 0.34, Fe_2O_3 5.96, FeO 5.57, MnO 9.76, MgO 0.31, CaO 1.66, K_2O 7.56, Na_2O 10.50, H_2O 8.12, CO_2 0.30, sum 99.25 wt%. If Fe is calculated as Fe^{2+} , the mineral would have $\text{Fe}^{2+} > \text{Mn}^{2+}$, whereas shafranovskite has $\text{Mn}^{2+} > \text{Fe}^{2+}$.

Discussion. The name "Fe-shafranovskite" was not approved by the IMA Commission on New Minerals because Fe^{3+} and Fe^{2+} can occupy different positions in the structure of the mineral. The analysis of fresh, unoxidized material is necessary to show that $\text{Fe}^{2+} > \text{Mn}^{2+}$. The name was rejected by the IMA Commission and should not have been used in any case. **J.P.**

Hingganite-(Ce)

R. Miyawaki, I. Nakai, K. Nagashima, A. Okamoto, T. Isobe (1987) The first occurrences of hingganite, helandite and wodginite in Japan. *Kobutsugaku Zasshi*, 18(1), 17–30 (in Japanese).

Electron-microprobe analysis gave FeO 5.65, Y_2O_3 10.91, La_2O_3 3.40, Ce_2O_3 16.77, Pr_2O_3 3.5, Nd_2O_3 9.79, Sm_2O_3 4.70, Eu_2O_3 trace, Gd_2O_3 4.18, Tb_2O_3 0.5, Dy_2O_3 3.82, Ho_2O_3 1.08, Er_2O_3 1.84, Tm_2O_3 trace, Yb_2O_3 1.02, Lu_2O_3 0.3, ($\Sigma\text{REE}_2\text{O}_3$ 61.81), CaO 0.39, BeO 9.27, B_2O_3 trace, SiO_2 22.27, H_2O (calc.) 1.90, sum 101.29 wt%. Pr, Tb, and Lu were estimated from peak intensities; Be was confirmed by ion microprobe to be a major constituent, and BeO was calculated to make equal the atomic ratios for Be and Si. The results correspond to $(\text{Ce}_{0.54}\text{Y}_{0.51}\text{Nd}_{0.31}\text{Sm}_{0.14}\text{Gd}_{0.12}\text{La}_{0.11}\text{Pr}_{0.11}\text{Dy}_{0.11}\text{Er}_{0.05}\text{Ho}_{0.03}\text{Yb}_{0.03}\text{Tb}_{0.01}\text{Lu}_{0.01}\text{Ca}_{0.04})_{\Sigma 2.12}\text{Fe}_{0.41}\text{Be}_{1.96}\text{Si}_{1.96}\text{O}_{8.87}(\text{OH})_{1.13}$, simplified as $(\text{Ce}, \text{Y})_2(\square, \text{Fe}^{2+})\text{Be}_2\text{Si}_2\text{O}_8(\text{OH}, \text{O})_2$. The mineral, which is described as hingganite-(Ce), occurs as light red-brown idiomorphic crystals 1 to 5 mm long. The X-ray powder pattern (Guinier-Hägg camera, $\text{CuK}\alpha_1$ radiation) has strongest lines of 4.799(s,001), 3.159(vs, $\bar{2}11,211$), 2.874(s, $\bar{1}21$), 2.870(s, 121), 2.577(s, $\bar{3}11,311$), and 2.565 Å (s, $\bar{2}21,221$); cell dimensions calculated from the pattern are $a = 9.996(10)$, $b = 7.705(7)$, $c = 4.792(4)$, $\beta = 90.06(4)^\circ$.

The mineral occurs in drusy pegmatite in the quarry of Iwaguro Sekizai Company, Tahara area, Gifu Prefecture, Japan. Associated minerals are quartz, feldspar, mica, cas-

site, stokesite, fluorite, and chlorite. Hingganite-(Y) from a nearby quarry also is described.

Discussion. Related to hingganite-(Y) [xinganite, yttruceberysite, *Am. Mineral.* 73, 441–442, and 73, 933 (1988)], and to hingganite-(Yb). Requires a more complete description and submission to the IMA for approval of the new name. **J.L.J.**

Isochalcopyrite

E. Missack, P. Stoffers, A. El Goresy (1989) Mineralogy, parageneses, and phase relations of copper-iron sulfides in the Atlantis II Deep, Red Sea. *Mineralium Deposita*, 24, 82–91.

Metalliferous sediments in a core taken in the southwest basin of the Atlantis II Deep contain a sulfide assemblage consisting most abundantly of chalcopyrite and intermediate solid solution (ISS) [named isocubanite, *Am. Mineral.*, 74, p. 503, 1989]; also present are sphalerite, pyrrhotite, pyrite, marcasite, mackinawite, and presumably wurtzite. Within isocubanite as exsolution lamellae along $\{111\}$ is an optically isotropic, yellow phase having a reflectivity lower than that of chalcopyrite. The phase also occurs as homogeneous rims on isocubanite and as xenomorphic individual grains or coexisting with pyrrhotite or isocubanite. An electron-microprobe analysis gave Cu 34.04, Fe 32.20, Zn 0.15, S 33.87, sum 100.26 wt%, corresponding to $\text{Cu}_{16.22}\text{Fe}_{17.47}\text{Zn}_{0.07}\text{S}_{32}$. Rims of exsolution lamellae have higher Cu/Fe ratios than the cores, and the composition varies between $\text{Cu}_{7.3}\text{Fe}_{9.6}\text{S}_{16}$ and $\text{Cu}_{8.2}\text{Fe}_{8.6}\text{S}_{16}$. It is suggested that the phase is probably cubic and may be equivalent to high-temperature, face-centered cubic chalcopyrite.

Discussion. An inadequate description of a phase that clearly should not have been named. **J.L.J.**

Odinite*

S.W. Bailey (1988) Odinite, a new dioctahedral-trioctahedral Fe-rich 1:1 clay mineral. *Clay Minerals*, 23, 237–247.

The mineral occurs at eleven localities and is estimated to be a minor component (0.1 to 10%) of sediments that cover more than 100 000 km² of the present-day sea bottom in tropical latitudes. Combined X-ray fluorescence and wet-chemical analyses are given of ten samples; the purest, from the Los Islands in the Koukoure River mouth off Guinea, gave SiO_2 36.0, Al_2O_3 12.2, Fe_2O_3 19.5, FeO 6.21, TiO_2 0.4, CaO 0.13, MgO 9.7, MnO 0.33, P_2O_5 0.17, Na_2O trace, K_2O 0.35, H_2O^- 4.10, H_2O^+ (+ CO_2) 10.96, sum 100.05 wt%, corresponding to $(\text{Fe}_{3.784}^{3+}\text{Mg}_{0.772}\text{Al}_{0.556}\text{Fe}_{0.279}^{2+}\text{Ti}_{0.016}\text{Mn}_{0.15})_{\Sigma 2.422}(\text{Si}_{1.788}\text{Al}_{0.212})\text{O}_5(\text{OH})_4$ after excluding the CaO , K_2O , and P_2O_5 as due to impurities, deducting 3% quartz impurity, and recalculating to a 100% anhydrous basis. The Mössbauer spectrum of another sample confirmed the $\text{Fe}^{3+}/\text{Fe}^{2+}$ ratios assigned in the analyses. Octahedral cation totals range from 2.30 to 2.54 cations per 3.0 sites for the ten analyzed samples. The

simplified formula of the mineral is $(R_{1.35}^{3+}R_{0.65}^{2+}\square_{0.60})(Si_{1.85}Al_{0.15})O_5(OH)_4$ with R^{3+} dominantly Fe, and R^{2+} dominantly Mg. The structure is based on a 1:1 serpentine-type layer that is intermediate between dioctahedral and trioctahedral. The mineral is silky green to dark green (similar to glauconite), gray-green when powdered, silky to earthy opaque luster, density not measurable with accuracy but close to that of quartz, optical properties not determinable, does not expand upon solvation with ethylene glycol, becomes amorphous on heating at 490 °C for 2 hours. The DTA curve shows a strong endotherm at 120 °C (loss of adsorbed water), and a less strong one at 550 °C (water extracted from the octahedral sheets). The infrared spectrum shows only a few wide absorption bands: 3420 and 1630 cm^{-1} (medium intensity; adsorbed water); 3560, 660, 680 (medium intensity; OH); a strong Si-O stretching-mode band at 1010 and shoulder at 990, and a strong bending-mode band at 455 (with a secondary band at 470 cm^{-1} for some samples). The X-ray powder pattern (114.6-mm Debye-Scherrer camera, $FeK\alpha_1$ radiation, 21 lines listed) shows a mixture of two 1:1 layer-silicate phases, one of which is a *IM* polytype (monoclinic, space group *Cm*), and the other trigonal or hexagonal (indexed in the pattern as *IT* for convenience). The monoclinic phase has been found in a pure state; both polytypes are present in most samples, with *IM* more abundant than *IT*. Strongest lines of the given mixed-phase pattern are 7.15(100,001 from both phases), 4.65(40, both 020), 4.53(20,110 *IM*), 3.58(85, both 002), 2.67(40,20 $\bar{1}$ and 130 *IM*, 200 and 130 *IT*), 2.41(30B, 20 $\bar{2}$ and 131 *IM*), 1.552(65, both 060, plus 33 $\bar{1}$ *IM* and 330 *IT*), 1.33(15B, several *IM*). Calculated cell dimensions are $a = 5.373(3)$, $b = 9.326(7)$, $c = 7.363(6)$ Å, $\beta = 104.0(1)^\circ$, and $a = 5.366(6)$, $c = 7.161(8)$.

The mineral is an authigenic component of the sediments. It occurs with quartz sand that commonly has a large component of carbonate bioclasts and smaller amounts of clay minerals and other detritus and is most evident at shallow marine depths (15 to 60 m) in areas where the detrital sedimentation rate is low and circulating currents are present. As odinite matures it hardens, changes to a darker green color, and alters to chlorite. Odinite has not been recognized in rocks older than the Recent Quaternary.

The new name is for Gilles S. Odin, Département de géologie dynamique, Université Pierre et Marie Curie, Paris, who made the original identification and did most of the pioneering work on the mineral. Type material, from a reef lagoon southwest of New Caledonia, has been deposited in the Museum national d'histoire naturelle, Paris, in the Smithsonian Institution, Washington, D.C., in the British Museum (Natural History), London, and in the École des mines, Paris. **J.L.J.**

Remondite-(Ce)*

F. Cesbron, C. Gilles, P. Pelisson, J.-C. Saugues (1988) Remondite-(Ce), a new rare-earth carbonate in the bur-

bankite group. C.R. Acad. Sci. Paris, series II, 915–920 (in French, extended English abstract).

D. Ginderov (1989) Structure of $Na_3M_3(CO_3)_5$ ($M =$ rare earths, Ca, Na, Sr), related to burbankite. Acta Crystallogr., C45, 185–187 (in French, English abstract).

Electron-microprobe and emission-spectroscopic analyses and thermogravimetric determination of CO_2 gave Na_2O 17.16, CaO 10.54, SrO 3.98, La_2O_3 11.60, Ce_2O_3 14.99, Pr_2O_3 1.49, Nd_2O_3 3.34, Sm_2O_3 0.50, Eu_2O_3 0.09, Gd_2O_3 0.24, Dy_2O_3 0.07, Ho_2O_3 0.01, Er_2O_3 0.03, Yb_2O_3 0.03, Lu_2O_3 0.004, Y_2O_3 0.24, CO_2 35.24, sum 99.554 wt%, corresponding to $Na_{3.00}(REE_{1.23}Ca_{1.17}Na_{0.46}Sr_{0.24})_{23.10}(CO_3)_5$, where $\Sigma REE = Ce_{0.57}La_{0.44}Nd_{0.12}Pr_{0.06}Sm_{0.02}Y_{0.01}Gd_{0.01}$. The mineral is orange-red, vitreous luster, transparent in splinters, imperfect cleavage, conchoidal fracture, $H = 3$ to 3.5, $D_{meas} = 3.43(1)$, $D_{calc} = 3.46$ g/cm³ with $Z = 2$, soluble in HCl and HNO_3 with effervescence. Optically biaxial positive, $\alpha = 1.632(2)$, $\beta = 1.633(2)$, $\gamma = 1.638(2)$ for sodium light, $2V_{meas} = 40(6)^\circ$, $2V_{calc} = 48^\circ$, compatibility index $1 - K_p/K_c = -0.005$ (superior). Crystal-structure analysis shows the mineral to be monoclinic, pseudo-hexagonal, space group $P2_1$, $a = 10.444(6)$, $b = 6.313(4)$, $c = 10.445(6)$ Å, $\beta = 119.86(5)^\circ$. The X-ray powder pattern (Guinier-de Wolff, $CuK\alpha_1$ radiation) has strongest lines of 5.17(40)(011, $\bar{1}$ 11), 3.010(40)(112), 3.006(70)($\bar{1}$ 13, $\bar{2}$ 13), 2.617(50)(202), 2.609(70)($\bar{2}$ 04), 2.589(100)(022, $\bar{2}$ 22), 2.132(70)(014), 2.127(50)($\bar{4}$ 14), and 1.908(40)(032, $\bar{2}$ 32).

The new name is for G. Remond, physicist at the Bureau de recherches géologiques et minières (BRGM), Orléans, France. The mineral occurs as massive fillings in veinlets that cut nepheline syenite orthogneiss at Ebounja, near Kribi, Cameroon. Associated minerals include cancrinite, sodalite, calcite, monazite, pyrochlore, betafite, bastnaesite, and nepheline. Type material is in the mineralogy collection of the École nationale supérieure des mines, Paris. **J.L.J.**

Shabaite-(Nd)*

M. Deliens, P. Piret (1989) Shabaite-(Nd), $Ca(REE)_x(VO_2)(CO_3)_4(OH)_6 \cdot 6H_2O$, a new mineral species from Kamoto, Shaba, Zaire. European Jour. Mineral., 1, 85–88 (in French).

Electron-microprobe analysis (mean of 10) and gas chromatography for C and H gave CaO 5.99, UO_3 30.32, Nd_2O_3 13.58, Sm_2O_3 5.54, Y_2O_3 4.91, Dy_2O_3 2.96, Pr_2O_3 2.36, La_2O_3 1.50, Ce_2O_3 0.50, CO_2 18.92, H_2O 13.49, sum 100.07 wt%, corresponding to $1.01Ca \cdot 0.94(REE)_2O_3 \cdot 1.00UO_2 \cdot 4.06CO_2 \cdot 7.07H_2O$ in which Nd 0.38, Sm 0.15, Y 0.21, Dy 0.07, Pr 0.07, La 0.04, Ce 0.02. The simplified formula is $Ca(Nd,Y)_2(VO_2)(CO_3)_4(OH)_6 \cdot 6H_2O$. The mineral occurs as pale yellow micaceous flakes and as rosettes up to 5 mm in diameter; translucent to opaque, pearly luster, $H = 2\frac{1}{2}$, tabular on {010}, elongate [100], twinned {001}, soluble in HCl. $D_{meas} = 3.13(10)$ (heavy liquids), $D_{calc} = 3.23$ g/cm³ with $Z = 5$. Microscopically pale yellow,

non-pleochroic, biaxial negative, $2V_{\text{meas}} = 44^\circ$, $\alpha = 1.534(2)$, $\beta_{\text{calc}} = 1.590(4)$, $\gamma = 1.600(2)$, $Y = b$, $Z \wedge a = 3-4^\circ$. X-ray single-crystal study indicated monoclinic symmetry; the only extinction condition is $0k0$, $k = 2n$, indicating possible space groups $P2_1$ or $P2_1/m$, but as these are incompatible with $Z = 5$, the choices suggested are $P2$, Pm , or $P2/m$. Cell dimensions, refined from the powder pattern (114.6-mm camera, $\text{CuK}\alpha$), are $a = 9.208(5)$, $b = 32.09(3)$, $c = 8.335(4)$ Å, $\beta = 90.3(1)^\circ$. Strongest lines of the powder pattern are 15.9(100)(020), 7.31(70)(021), 4.58(50)(210), 4.01(30)(080, $\bar{2}11, 211$), and 3.072(60B)(202,300).

The mineral occurs with uraninite, kamotoite-(Y), schuilingite-(Nd), and uranophane in the copper-cobalt deposit of East Kamoto, 5 km west of Kolwézi, Shaba province, Zaire. The name is for the region. Type material is at the Institut royal des sciences naturelles de Belgique, Brussels, Belgium. J.L.J.

Ni_3Sn_2

F. Ulff-Møller (1989) Exsolution of metallic Pb liquid in a magmatic sulfide-metal lens from Disko, central West Greenland. *Neues Jahrb. Mineral. Abh.*, 160, 193–206.

Iron- and sulfide-rich assemblages occur in a 100-kg magmatic sulfide and metal lens in a dike at Disko, Greenland. The lens contains troilite, metallic iron, chromite, magnetite after wüstite, pentlandite, galena, chalcopyrite, cubanite, shandite, native lead, altaite, and traces of nickel-tin alloy. Electron-microprobe analysis of the alloy gave Ni 36.9, Cu 3.38, Fe 0.78, Sn 50.8, Pb 0.88, S 0.28, sum 92.9 wt%. Energy-dispersive analysis showed that no other elements are present, and that S is extraneous and probably results from beam overlap on adjacent phases; the low analytical total is attributed to an oxide-coated or pitted surface. The analysis corresponds to $(\text{Ni}_{55.78}\text{Cu}_{4.73}\text{Fe}_{1.11})(\text{Sn}_{37.99}\text{Pb}_{0.38})$, simplified as $(\text{Ni,Cu,Fe})_{3.21}(\text{Sn,Pb})_{2.00}$, ideally Ni_3Sn_2 . In polished section the alloy is similar to altaite in appearance, but has a faint rosy tinge. The alloy is known as a synthetic phase.

Discussion. Grain sizes are not given, but evidently the phase is much too small to obtain X-ray data. J.L.J.

$\text{Fe}_{1-x}\text{S-Ni}_{1-x}\text{S}$ *Mss*

J. Lu, N. Wang, S. Schmidt (1989) Ore minerals: An experimental approach and new observations. IV. Nickel containing sulfides and related experimentation. Natural occurrences of *Mss* in the Fe-Ni-S ternary system. *Neues Jahrb. Mineral. Abh.*, 160, 46–50 (and 63–69 for references).

In the Fe-Ni-S ternary system an extensive solid-solution range known as *Mss* exists between Fe_{1-x}S and Ni_{1-x}S at 300 °C and higher temperatures. Natural counterparts of the *Mss* have been found at two localities in China. At Hongge, southwestern Sichuan province, the phase occurs with pentlandite, violarite, pyrrhotite, siegenite, chalcopyrite, and pyrite associated with vanadium-

bearing titaniferous magnetite in the basal part of rhythmic layers of basic-ultrabasic intrusions. Two electron-microprobe analyses gave Fe 29.96, 28.88; Ni 30.17, 27.25; Co 2.65, 6.97; Cu 0.08, —; S 36.02, 35.71; sum 98.88 and 98.81 wt%; corresponding to (at%) $\text{Fe}_{24.16}(\text{Ni}_{23.15}\text{Co}_{2.03}\text{Cu}_{0.06})_{225.24}\text{S}_{50.60}$ and $\text{Fe}_{23.37}(\text{Ni}_{20.97}\text{Co}_{5.34})_{226.31}\text{S}_{50.32}$. At Jinchuan, northwestern Gansu Province, the phase occurs with pyrrhotite, pentlandite, cubanite, and other sulfides in ore-bearing ultramafic dikes. Nine electron-microprobe analyses are given and the average for thirty-one analyses is 52.27 at% S and 53.57 at% for the ratio $(\text{Ni} + \text{Co} + \text{Cu})/(\text{Fe} + \text{Ni} + \text{Co} + \text{Cu})$.

The phase, which formed by replacement of pentlandite, is anisotropic, reflection color browner than that of pentlandite but less brown than pyrrhotite, distinct reflection pleochroism, polarization colors brown to yellowish white, reflectivity 41% at 546 nm in air, hardness less than that of pentlandite and pyrrhotite but higher than that of chalcopyrite.

Discussion. The mineral also is reported to occur with pyrrhotite, pentlandite, and djerfisherite in eclogite xenoliths in a kimberlite pipe in the USSR (*Doklady Akad. Nauk SSSR*, 306(1), 176–180, 1989.) Detailed X-ray powder data for compositions across the synthetic *Mss* field are given by Shewman and Clark in *Can. J. Earth Sci.*, 7, 67–85, 1970. See also *Am. Mineral.*, 74, 981–993 (1989), where sulfide spherules in tephra from Mount Shasta, California, are reported to contain *Mss* as two intergrown lamellar phases, one with 13.9–19.7 at% Ni, and the other Ni-poor (6.2–12.0 at% Ni). J.L.J.

AuBi_5S_4

S. Hamasaki, S. Murao, K. Hoshino, M. Watanabe (1986) Unnamed Au-Bi sulfide from the Tsugahira mine, southern Kyushu, SW Japan. *Neues Jahrb. Mineral. Mon.*, 416–422.

G. Dobosi, B. Nagy (1989) The occurrence of an Au-Bi sulfide in the Nagyborzsöny hydrothermal ore deposit, Northern Hungary. *Neues Jahrb. Mineral. Mon.*, 8–14.

Electron-microprobe analysis of the sole grain, 15 by 40 μm , found in a specimen from the former Tsugahira mine in southwestern Japan gave Au 15.36, Bi 75.34, S 9.41, sum 100.11 wt%, corresponding to $\text{Au}_{1.06}\text{Bi}_{4.93}\text{S}_{4.01}$, ideally AuBi_5S_4 . In reflected light, light grayish white, very weak reflection pleochroism, distinct anisotropism like that of joseite-B, polarization colors from brownish tinted dark gray, to yellowish gray. Hardness greater than that of native bismuth, similar to that of joseite and joseite-B. Reflectance percentages (WTiC standard) are 482 nm 47.7–49.5; 545 47.8–49.0; 589 47.4–49.0; 659 48.4–50.5. The grain occurs in close association with native bismuth, joseite, and joseite-B in a specimen from Au-Bi-W tourmaline-quartz veins related to a Miocene granitic stock. Wolframite, arsenopyrite, and pyrite were formed early, and pyrrhotite, chalcopyrite, native bismuth, bismuthinite, joseite, joseite-B, maldonite, argentian gold, and the unnamed mineral were formed later. The type grain is in

a polished section at the Institute of Geology and Mineralogy, Hiroshima University, Japan.

Electron-microprobe analyses of two of three grains found in core from a drillhole at the former gold-producing Nagybörzsöny deposit, Börzsöny Mountains, Hungary, gave Au 14.81, 14.87; Ag 0.12, 0.28; Bi 68.39, 71.11; Pb 5.95, 4.31; S 9.81, 9.75; sum 99.08, 100.32 wt%, corresponding to $Au_{1.02}Ag_{0.03}(Bi_{4.58}Pb_{0.28})_{24.86}S_{4.09}$, or $Au(Bi,Pb)_5S_4$. The grains are intergrown with native gold and a bismuth sulfide tentatively identified as Se-free ikunolite; grain size not stated (but a photo indicates a probable maximum of about 8 by 25 μm). Reflectance higher than those of bismuthinite and ikunolite(?), less than that of arsenopyrite. Occurs with chalcopyrite, pyrite, arsenopyrite, lillianite(?), native bismuth, bismuthinite, ikunolite(?), and native gold in a stockwork zone in a propylitized dacite breccia pipe in Miocene calc-alkaline volcanics. The polished section containing the three grains of the unnamed mineral is the Laboratory for Geochemical Research of the Hungarian Academy of Science.

Discussion. Also reported, without X-ray diffraction data, in *Izvestiya Akad. Nauk Kazakh. SSR*, Ser. Geol. (2), 13–23 (1989) and in *Am. Mineral.*, 74, 949 (1989). J.L.J.

Unnamed $Cu_2Fe_3S_3$ phases

N.I. Organova, M.N. Sokolova, M.G. Dobrovolskaya, A.I. Cepin, A.L. Dmitrik (1983) On chalcopyrite-like and sphalerite-like phases of the platy K-bearing sulfide. *Mineral. Rudnykh Mestorozhd.* 1983, 109–115 (in Russian).

Electron-microprobe and detailed X-ray study of platy grains from pegmatites of the apatitic deposits of the Khibiny massive (Kola Peninsula, USSR) demonstrated the presence of rasvumite in intergrowths with two phases:

- 1) $Cu_2Fe_3S_3$ (Cu 44.36, Fe 19.79, K 0.59, S 31.98, sum 96.72 wt%), space group $I\bar{4}2d$ (?), $a = 5.258 \text{ \AA}$.
- 2) Supposedly $Cu_2Fe_3S_3$ (no microprobe analysis possible because of small grain size), space group $F\bar{4}3m$, $a = 5.406 \text{ \AA}$.

Discussion. More detailed data are necessary if one, or two(?) new minerals are to be proposed. J.P.

Unnamed sulfides of Ag, Cu, Hg and Fe

I.Ya. Nekrasov, G.N. Gamyarin, N.A. Goryachev, Yu.Ya. Zhdanov, E.M. Goryacheva, N.V. Leskova (1987) Mineralogical and geochemical peculiarities of silver mineralization in the Verkhoyan-Kolymian Folded Region. Mineral associations of ores of the silver-antimony and gold-silver formations. *Mineral. Zhurnal*, 9(6), 5–17 (in Russian).

In the volcanic Aid and Alfa silver ore deposits of the Verkhoyan-Kolymian Fold Zone, Siberia, USSR, the following unnamed sulfides were found:



Microprobe analysis (average of three) gave Ag 43.7, Hg 39.7, S 13.7, sum 97.1 wt%. The mineral occurs in association with acanthite and silver-copper sulfide (see below) as grains <0.01 mm in diameter.



The average of two microprobe analyses gave Ag 20.7, Cu 51.6, S 29.4, sum 101.7 wt%. Small (<0.01 mm in diameter) grains of the mineral are associated with acanthite and a silver-mercury sulfide (see above).

Mineral X

The average of three microprobe analyses gave Ag 44.1, Cu 1.4, Fe 22.8, Se 0.4, S 30.9, sum 99.6 wt%. The mineral forms rims 0.1 mm wide on grains of silver-bearing chalcopyrite. No formula is given.

Cu_2AgS

The mineral is mentioned as a “new phase” in the abstract, but no data are given.

Discussion. Ag_2HgS_2 corresponds to the composition of imiterite (*Am. Mineral.*, 71, 1277–1278, 1986). Mineral X approximates the analyses reported for $AgFeS_2$ (*Am. Mineral.*, 73, p. 1497, 1988). J.P.

Unnamed Bi sulfotelluride and Pb sulfobismuthide

M.A. Kudrina, V.S. Kudrin, A.M. Materikova, E.G. Ryabeva, K.V. Yurkina (1986) Bismuth minerals from a stratiform skarnoid-type deposit. *Novye Dannye Mineral.*, 33, 86–93 (in Russian).

Microprobe analysis of a mineral occurring in the Bayan tungsten ore deposit (Kazakhstan, USSR) gave Bi 78, Pb 1.8, Te 12.2, S 7.8, sum 99.8 wt%. The mineral is closely intergrown with bismuthinite and galenobismuthite. X-ray study was not possible because of the small grain size, and no formula is given. The mineral is reported to be similar to grüningite and joseite.

Microprobe analysis of a “lead sulfobismuthide” occurring in intergrowths with bismuthinite in the Bayan tungsten ore deposit in Kazakhstan (USSR) gave Bi 55.7, Pb 27.0, S 17.8, sum 99.4 wt%.

Discussion. The analysis and accompanying X-ray data indicate that the lead sulfobismuthide is galenobismuthite, $PbBi_2S_4$. J.P.

$Pb_2As_8S_{17}$ and argentiferous baumhauerite

A. Laroussi, Y. Moëlo, D. Ohnenstetter, D. Ginderow (1989) Silver and thallium in sulfosalts of the sartorite series (Lengenbach, Binn valley, Switzerland). *C.R. Acad.*

Sci. Paris, Series II, 308, 927–933 (in French, extended English abstract).

Electron-microprobe analyses of "Mineral A" gave Pb 46.1, 44.3, Tl 0.65, 2.35, As 27.2, 28.2, Sb 0.80, 0.85, S 25.0, 24.9, sum 100.3, 100.6 wt%, corresponding to $Pb_{4.84}Tl_{0.08}(As_{8.03}Sb_{0.14})_{28.17}S_{17}$ and $Pb_{4.67}Tl_{0.26}(As_{8.21}Sb_{0.15})_{28.36}S_{17}$, close to the ideal formula $Pb_5As_8S_{17}$. Associated with rathite and Ag-rich baumhauerite. Tl ranges from 0.6 to 4.7 wt%, but Ag is absent. The proposed general formula that reflects solid solution is $Pb_{5-2x}Tl_xAs_{8+x}S_{17}$ where $0.06 < x < 0.50$. Single-crystal X-ray study of a fragment gave cell parameters for sartorite, indicating intergrowth of sartorite and Mineral A.

Microprobe analysis (one of three listed) for "argentiferous baumhauerite" gave Pb 46.4, Tl 0.45, Ag 1.50, As 26.6, Sb not detected, S 24.5, sum 99.5 wt%, corresponding to $Pb_{10.54}(Ag_{0.65}Tl_{0.10})_{20.75}As_{16.68}S_{36}$, ideally $[Pb_{10}AgAs]As_{16}S_{36}$. Ag ranges from 1.4 to 2.1 wt%, and Tl from 0 to 0.8%. The mineral occurs in lamellar intergrowth with baumhauerite, but the two are separate phases and do not form a continuous solid solution. Microprobe analyses of the baumhauerite indicate up to 0.8 wt% Ag and 0.9% Tl, and the results are in good agreement with the ideal formula $Pb_{12}As_{16}S_{36}$. It is probable that the baumhauerite studied by Engel and Nowacki (*Z. Kristallogr.*, 123, 178–202, 1969) was "argentiferous baumhauerite" as defined here, rather than baumhauerite proper. **J.L.J.**

Unnamed Al sulfate

S.F. Velizade, N.F. Nagiev, A.B. Shiraliev, E.N. Efendieva (1987) Sulfates from the Byulyuldyuzu ore occurrence (Lower Caucasus). *Izvestiya Akad. Nauk Azerb. SSR, Ser. Nauk Zemle*, 1987(4), 112–120 (in Russian).

On the basis of six X-ray diffraction lines a mineral has been identified as identical to synthetic $Al_2(SO_4)_3 \cdot 12H_2O$. The mineral occurs in strongly hydrothermally altered ore-bearing rocks of the Byulyuldyuzu deposit (Lower Caucasus, USSR). **J.P.**

Fluorine analogue of thalenite-(Y)

O.V. Yakubovich, A.V. Voloshin, Ya.A. Pakhomovskii, M.A. Simonov (1988) Refined crystal structure of thalenite. *Kristallografiya*, 33, 605–608 (in Russian).

A.V. Voloshin, Ya.A. Pakhomovskii, F.N. Tyusheva (1985) Keiviite-(Y)—A new yttrian diorthosilicate, and thalenite from amazonite pegmatites of the Kola Peninsula. Diortho- and triorthosilicates of yttrium. *Mineralog. Zhurnal*, 7(6), 79–94 (in Russian).

Microprobe analyses (4 available) gave Y_2O_3 55.98, Yb_2O_3 2.40, Er_2O_3 2.92, Dy_2O_3 1.77, Lu_2O_3 0.19, Gd_2O_3 0.24, Tm_2O_3 0.26, Ho_2O_3 0.22, SiO_2 33.76, F 3.39, sum 99.68 wt%, corresponding to $[Y_{2.70}Yb_{0.07}Er_{0.08}Dy_{0.05}(Lu,Gd,Tm,Ho)_{0.03}]_{22.95}Si_{3.06}O_{10}F_{0.97}(OH)_{0.03}$, ideally $Y_3[Si_3O_{10}]F$. Single-crystal X-ray study showed the mineral to be

monoclinic, $a = 7.318(2)$, $b = 11.134(3)$, $c = 10.379(3)$ Å, $\beta = 97.24(2)^\circ$, space group $P2_1/n$, $Z = 4$, $D_{calc} = 4.29$ g/cm³. The strongest X-ray diffraction lines (24 given) are 5.60(50)(020), 3.81(50)(220), 3.12(100)(131), and 2.248(80, diffuse, 232,113,123). Optical properties are similar to those of thalenite: $\alpha = 1.719$, $\beta = 1.739$, $\gamma = 1.748$, $2V = 73^\circ$, $r < v$. The infrared spectrum is given. The mineral occurs as anhedral to subhedral inclusions in fluorite or as transparent, colorless crystals in fissures in fluorite and quartz from amazonite pegmatites of the Kola Peninsula (USSR).

Discussion. A previous X-ray crystal-structure and compositional study of thalenite-(Y) by A.N. Kornev et al. (*Doklady Akad. Nauk SSSR*, 202(6), 1324–1327, 1972) indicated that the mineral must contain OH groups and its formula should be written as $Y_3[Si_3O_{10}](OH)$. The fluorine analogue is apparently a new mineral and should be submitted to the IMA for approval. **J.P.**

Unnamed Na-Ca-Zr silicate

A.P. Khomyakov, D.Yu. Pushcharovskii, I.M. Kulikova, V.I. Kuz'min (1988) New representative of the hiordahlite-lavenite mineralogical group. *Vestnik Mosk. Univ. Geol.*, 43(1), 87–92 (English translation of Russian).

An unnamed mineral (Phase A) occurs in fenitized hornfelsic sandstone at the contact of the Burpala massive, northern Baikal region, Transbaikal, USSR, within segregations containing catapleite, astrophyllite, fluorite, and loparite. Phase A forms tablets up to $0.3 \times 1 \times 5$ mm, commonly fan-shaped, that typically consist of domains of Phase A and lavenite in various proportions, but crystals free of lavenite are known. Electron-microprobe analysis gave (average of four) SiO_2 31.82, ZrO_2 31.11, TiO_2 1.05, Nb_2O_5 0.22, FeO 0.43, MnO 0.60, CaO 14.52, Na_2O 13.86, Y_2O_3 0.32, F 8.10, H_2O (gravimetric) 1.23, less O \equiv F 3.41, sum 99.86 wt%, corresponding to $(Na_{1.69}Mn_{0.03}Fe_{0.02}Y_{0.01})_{21.75}Ca_{0.98}(Zr_{0.95}Ti_{0.05}Nb_{0.01})_{21.01}(Si_2O_7)(F_{1.61}OH_{0.22})_{21.83} \cdot 0.15H_2O$, ideally $Na_2CaZr(Si_2O_7)F_{25}$, the same as the formula for lavenite. In contrast to the clearly monoclinic character of the lavenite unit cell ($\beta = \sim 110^\circ$), single-crystal X-ray study of Phase A showed it to be pseudo-orthorhombic, $a = 10.117$, $b = 10.445$, $c = 7.256$ Å, $\beta = 90.04^\circ$. Strongest lines of the diffractometer pattern (Cu radiation) are 5.23(25,020), 3.30(40,130), 3.20(20,310), 2.95(100,202), 2.87(60,230), 2.84(25,212), and 1.784(20,350,043); indexing is given only for the positive indices. Crystals are elongate [001], flattened [010], and show {010}, {110}, {001}, less commonly {011}, {101}, and {111}. Transparent, to translucent with a weak yellowish tint, vitreous luster, white streak, no cleavage, conchoidal fracture, $H = 5-6$, $D_{meas} = 3.33(15)$ g/cm³, readily soluble in 10% HCl, glows a weak yellow-orange in X-rays. Optically biaxial negative, $\alpha = 1.627(2)$, $\beta = 1.634(2)$, $\gamma = 1.639(2)$, $2V_{calc} = 80.1^\circ$, weak dispersion $r < v$, $X \parallel b$, $Y = c$, $Z = a$. The mineral is considered to be a polymorph

of lavenite, and the authors note that so-called "rhombic lavenite" described in the past is considered to have been derived by twinning (*Am. Mineral.*, 51, 1549–1550, 1966).

Discussion. The authors, most commendably, have deferred the naming of the mineral pending completion of a crystal-structure analysis. **J.L.J.**

New Data

Beckelite

L.G. Feldman, S.Sh. Sarkisian, V.P. Boriskin, S.P. Purusova, N.V. Khoay, C.C. Ben (1987) Crystalline beckelite from the Nam Se deposit (North Vietnam). *Mineralog. Zhurnal*, 9(1), 78–86 (in Russian).

X-ray study of non-metamict beckelite from the Nam Se deposit in northern Vietnam yielded $a = 9.61(1)$, $c = 7.05(1)$ Å. Wet-chemical analysis of the mineral gave SiO₂ 16.95, Al₂O₃ 0.17, Fe₂O₃ 0.49, ΣCe₂O₃ 66.84, ΣY₂O₃ 0.27, Y₂O₃ 0.68, ThO₂ 0.18, CaO 8.81, Na₂O 0.14, MnO 0.14, MgO 0.10, F 4.43, H₂O 2.67, O = F₂ 1.87, sum 100.00 wt%, corresponding to Ca_{2.89}Na_{0.09}Mn_{0.04}REE_{7.49}Y_{0.01}Th_{0.01}Σ_{10.63}[(Si_{5.18}Al_{0.08}Fe_{0.11}³⁺)_{25.37}O_{22.89}F_{1.11}]_{3.18}·2.72H₂O.

Discussion. Both the X-ray and chemical data correspond to britholite. **J.P.**

Ferrihydrite

R.A. Eggleton, R.W. Fitzpatrick (1988) New data and a revised structural model for ferrihydrite. *Clays Clay Minerals*, 36, 111–124.

Ferrihydrite is a poorly crystalline, hydrated ferric oxyhydroxide. Many ferrihydrite samples have been imaged by TEM, and all show an aggregate of spheres, ranging from 30 to 70 Å in diameter. X-ray powder patterns vary from those showing two very broad maxima at about 2.54 and 1.5 Å, indicating poorly crystalline material, to patterns that show six broad but distinct peaks between 2.56 and 1.48 Å. Consequently, ferrihydrite samples have come to be described as, for example, 2-line, 4-line, or 6-line ferrihydrite. The broad diffraction lines probably result from small crystal size rather than from deformed crystals or noncrystalline material. The structural model proposed is based on four planes of close-packed oxygens and hydroxyls (ABAC sequence), with two adjacent layers of iron in octahedral coordination, followed by two layers of tetrahedral iron, probably sharing vertices. The iron distribution in any layer is semi-random, giving an average iron occupancy of 1/2 in each site, but tending toward alternation between occupancy and vacancy for short distances. The unit cell is trigonal, $a = 5.08$, $c = 9.4$ Å. Powder-diffraction peaks for 2-line ferrihydrite correspond to the Miller indices 110 and 115+300, and those for 6-line ferrihydrite (d , F_o , hkl) are 2.52(52,110), 2.23(38,112), 1.98(29,113), 1.72(34,114), 1.51(50,115),

and 1.46(87,300). The structural formula is FeO(OH), but it depends on crystal size and is modified also by high surface-water content to a composition between Fe₄(OH)₁₂ and Fe₅O₃(OH)₆. Most samples of natural ferrihydrite contain appreciable silica; the presence of tetrahedral Si in substitution for Fe³⁺ is possible in the proposed structural model, but Si might introduce structural distortions and limit ferrihydrite growth. **J.L.J.**

Lacroixite

A.-M. Franolet (1989) The problem of Na-Li substitution in primary Li-Al phosphates: New data on lacroixite, a relatively widespread mineral. *Can. Mineral.*, 27, 211–217.

Wet-chemical and electron-microprobe analyses of lacroixite from the Rusororo and Burunga pegmatites, Rwanda, indicate that substantial substitution of Li for Na, and OH for F, may occur. **J.L.J.**

Magnolite

A.C. Roberts, M. Bonardi, J.D. Grice, T.S. Ercit, W.W. Pinch (1989) A restudy of magnolite, Hg₂⁺Te⁴⁺O₃, from Colorado. *Can. Mineral.*, 27, 129–131.

J.D. Grice (1989) The crystal structure of magnolite. *Can. Mineral.*, 27, 133–136.

Museum specimens of magnolite from the type locality, Keystone mine, Boulder County, Colorado, and from the Mt. Lion mine, in the same county, are orthorhombic, space group *Pbm2*, $a = 5.948(4)$, $b = 10.580(9)$, $c = 3.745(2)$ Å as refined from the X-ray powder pattern (114.6-mm Debye-Scherrer camera, Cu radiation). Five electron-microprobe analyses of crystals from the Keystone mine averaged Hg₂O 72.3(6), TeO₂ 28.9(5), sum 101.2 wt%, corresponding to Hg_{1.54}Te_{1.01}⁴⁺O₃, ideally Hg₂TeO₃. The mineral occurs as radiating tufts of acicular needles on fracture surfaces and as masses of parallel to subparallel bladed crystals, typically coated with a thin veneer of native mercury, in cracks and cavities of the quartz-bearing host rock. Needles are up to 0.5 mm long, elongate [001], creamy white, soft, opaque, silky luster. Bladed crystals are up to 1 mm long, showing {100} and {010}, elongate [001], colorless, transparent to translucent, adamantine luster, brittle, perfect cleavage along the elongation and good cleavage normal to it, nonfluorescent. $D_{\text{calc}} = 8.12$ g/cm³ for the ideal formula and $Z = 2$. Optically biaxial positive, $2V \geq 45^\circ$, refractive indices are >2 , $X = b$, $Y = a$, $Z = c$. Crystals from the Mt. Lion mine are light yellow-green but otherwise are similar to material from the Keystone mine.

The name was proposed by F.A. Genth in 1877 for a new "mercurous tellurate" with the probable formula Hg₂TeO₄. The re-examination confirms the basics of the original description, except that the formula is Hg₂TeO₃. **J.L.J.**

Discredited Mineral**Kirwanite**

R. Nawaz, G. Ryback (1989) Re-examination of kirwanite: A ferri-ferro-hornblende from Co. Down, Northern Ireland. *Mineral. Mag.*, 53, 253–255.

The name “kirwanite” generally has been accepted to have been inappropriately used for a mixture of altered amphibole, quartz, and epidote. Re-examination of specimens from the type locality shows that kirwanite is an amphibole of composition $(\text{Na}, \text{K})_{0.10}\text{Ca}_{1.80}(\text{Fe}^{2+}, \text{Mn})_{3.10}\text{Mg}_{0.79}\text{Fe}_{1.14}^{3+}\text{Al}_{0.78}\text{Si}_{7.18}\text{O}_{22}(\text{OH})_2$, thus corresponding to ferri-ferro-hornblende. **J.L.J.**