

NEW MINERAL NAMES

MICHAEL FLEISCHER

Hocartite

R. CAYE, Y. LAURENT, P. PICOT, R. PIERROT, AND C. LEVY, (1968). La hocartite, $Ag_8Sn \cdot FeS_4$, une nouvelle espece minerale. *Bull. Soc. Franc. Mineral Cristallogr.* 91, 383-387.

Microprobe analyses of 4 samples from Tacama by R. Giraud gave Sn 28.0, 26.6, 25.5, 25.0; Ag 36.0, 36.0, 36.0, 36.0; Cu 1.8, 1.8, 1.8, 1.8, Fe 7.7, 7.7, 7.5, 7.6; Zu 4.0, 4.0, 4.2, 4.2; S 27.0, 26.9, 26.4, 26.0; sum 104.5, 103.0, 103.4, 100.6%. The average gives (Ag_{8.66}Cu_{0.14})Sn_{1.10}(Fe_{0.67}Zn_{0.31})S_{4.12}, the silver analogue of stannite.

The X-ray powder pattern is very similar to that of stannite; it is indexed on a tetragonal cell with $a = 5.74 \pm 0.03$, $c = 10.96 \pm 0.05$ Å. The strongest lines are 3.26 (10)(112), 2.87 (4)(020), 2.03 (5)(220), 1.98 (8)(024), 1.72 (7)(312).

The mineral is brownish-gray in polished section, very nearly the same as canfieldite. It polishes well; hardness similar to that of stannite. Reflectivity measurements on 6 samples are given at 12 wavelengths from 4200 to 6400 Å μ ; they range from 22.3 to 25.0, and unlike stannite and canfieldite they vary little with wave length. Uniaxial, negative. Pleochroism weak, gray-brown to violet-gray; anisotropy distinct under crossed nicols with orange to greenish polarization colors. Polysynthetic twinning common.

Hocartite occurs in grains less than a millimeter in size as inclusions in sphalerite and wurtzite and in oriented intergrowths with stannite at the tin mines of Tacama, Hocaya, and Chocaya, Bolivia, and at Fournial, Cantal, France.

The name is for Raymond Hocart, Professor of Mineralogy, University of Paris. The mineral and name were approved in advance of publication by the Commission on New Minerals and Mineral Names, IMA. Type material is preserved at the Ecole Nat. Supérieure des Mines, Paris.

Tintinaite

D. C. HARRIS, J. L. JAMBOR, G. R. LACHANCE, R. I. THORPE (1968) Tintinaite, the antimony analogue of kobellite. *Can. Mineral.*, 9, 371-382.

This mineral was abstracted previously *Amer. Mineral.*, 52, 1580 (1967) as an unnamed new Pb-Sb sulfide. The complete description has now been published. Electron microprobe analyses of material from four different localities gave the following results: Hvena, Sweden Pb 33.2, Bi 37.6, Sb 9.6, Cu 1.0, Ag 0.5, Fe 0.6, S 18.6, total 101.1; Raleigh, North Carolina Pb 38.0, Bi 28.5, Sb 15.0, S 18.0, total 99.5; Rosslund, B. C. Pb 42.3, Bi 23.0, Sb 17.6, Cu, Ag, and Fe not detected, S 20.0, total 102.9; Tintina, Yukon Pb 42.3, Bi not detected, Sb 34.5, Cu, Ag and Fe not detected, S 21.3, total 98.1%. Analysis of the Hvena mineral was performed by J. C. Rucklidge of the University of Toronto; the other analyses by G. R. Lachance. Formulas derived from the analyses correspond well to $5PbS \cdot 4X_2S_3$ where X is Bi and/or Sb. The atomic % of bismuth in the (Bi, Sb) position for the four specimens is: Hvena 69.6, Raleigh 52.4, Rosslund 43.5, and Tintina 0.0. Thus, the Hvena and Raleigh minerals are antimonian kobellites, the Rosslund mineral is a bismuthian tintinaite, and the Tintina mineral is the pure Sb end-member, tintinaite.

Single-crystal X-ray study gave space group $Pnmm$ for each of the analyzed specimens. Unit cell parameters (in Å) are:

	Hvena	Raleigh	Rosslund	Tintina
a	22.62	22.53	22.50	22.30
b	34.08	33.97	34.00	34.00
c	4.02	4.04	4.03	4.04

The linear variation of the a dimension with composition may permit the a value to be used as a measure of the atomic percent of Bi (or Sb). X-ray powder data (114.6 mm. diam. camera, Ni-filtered Cu radiation) are given for all four specimens. The data for Hvena and Tintina are indexed. For the Hvena kobellite (31 indexed spacings and 4 others), the strongest lines (in Å) are: 3.54 (10)(560), 3.41 (9)(0.10.0), 2.72 (5)(381, 471), 3.98 (4)(460, 540), and 3.27 (4)(341). For Tintina tintinaite (39 indexed spacings and 3 others), the strongest lines (in Å) are: 3.40 (10)(640, 0.10.0, 331), 3.51 (8)(560), 2.71 (7)(381, 471), 2.022 (6)(—), and 2.87 (5)(371). A characteristic feature of the Tintina pattern is the medium strong spacing at 2.022 (6) which appears as a doublet (2.039 and 2.019) in the other patterns.

The pure tintinaite occurs at the Tintina Silver Mines, Yukon, Canada, as small masses up to 2 mm in diameter and as veinlets filling interstices and fractures in malachite-stained weathered quartz. Color is lead-gray with a black streak and metallic luster. It has a well-developed {010} cleavage. The Talmage hardness is C-. Tintinaite is associated with jamesonite. Other minerals in the area are: argentic tetrahedrite, galena, sphalerite, pyrite, arsenopyrite, marcasite, bourmonite, owyheite, pyrrhotite, and chalcopyrite. The Rossland tintinaite was found on the dump of the Deer Park mine, Rossland, British Columbia, Canada. It occurs as blades in granular quartz. The blades sometimes form parallel aggregates up to 2 mm by 0.5 mm. Somewhat radiating fibrous clusters also occur. The mineral is associated with pyrite, arsenopyrite, pyrrhotite, chalcopyrite, and magnetite.

The density of Tintina material is 5.48 (calc) and 5.51 (predicted). For Hvena Kobellite the density is 6.51 (calc) and 6.48 (meas).

Rotation and reflectivity measurements for Rossland material are as follows: at 546 nm the rotation angle Ar is 1.84° and the phase difference 2θ is $0.8^\circ+$; approximate uniaxial reflectivities at 546 nm are R_p 36.6, R_m 39.0 to 41.1 and R_g 45.4.

Type specimens of the Rossland bismuthian tintinaite are preserved in the mineral collections of the Royal Ontario Museum, Toronto. The studied Tintina tintinaite is preserved in the systematic collections of the Geological Survey of Canada, Ottawa; others are in the research collections of the Dept. of Geology, University of Toronto.

DISCUSSION.—The authors propose that the series be designated as the kobellite series and that those members with atomic ratio Bi:Sb < 1 be called tintinaite and those with Bi:Sb > 1 be called kobellite. The name was approved before publication by the Commission on New Minerals and Mineral Names, IMA.

J. A. Mandarino

Nuffieldite

P. W. KINGSTON (1968) Studies of mineral sulphosalts: XXI-Nuffieldite, a new species. *Can. Mineral.*, 9, 439–452.

A mineral which occurs in a small quartz vein in the Lime Creek stock near Alice Arm, British Columbia, is a new sulfo-salt. The mineral has a bright metallic luster and is shiny lead-gray to steel gray in color on freshly broken surfaces. The surface tarnishes to a pale iridescent grayish-green to reddish brown color. The streak is dark greenish-gray to black. Some of the crystals are prismatic to acicular in habit and are deeply striated and channelled parallel to [001]. Usually, the crystals are about 1 mm long by 0.01 mm to 0.03 mm in diameter, but some attain a length of 3 mm. Another habit consists of sub-parallel aggregates of stubby deeply striated prisms, with individuals averaging 0.5 mm by 0.2 mm in diameter. Both types of crystals are unterminated. The mineral is very brittle. Fracture uneven to flat conchoidal. Cleavage indistinct normal to [001] and excellent parallel to

[001]. The latter may really be the easy separation of parallel needles. Long needles are quite elastic. The measured density (Berman balance) is 7.01 ± 0.07 .

Reflectivity and micro-hardness values were determined by Prof. W. Uytendogaardt. Vickers hardness of nuffieldite is 149–178 as compared to 201–218 for aikinite (15 g. load). The minimum and maximum reflectivity values (in %) are: 470 nm, 39.8–45.6; 546 nm, 39.0–44.9; and 589 nm, 38.6–44.5.

In polished section, the mineral shows no reflection pleochroism. It is very weakly anisotropic, with polarization colors bluish-gray to grayish-red. The mineral is pale creamy-white. No twinning was detected in the polished section.

Single crystal X-ray data indicate the space group $Pn\bar{m}$ or $Pna2_1$. Refined unit cell parameters are: $a = 14.602 \pm 0.006$, $b = 21.344 \pm 0.011$, $c = 4.026 \pm 0.002$ (all in Å).

Forty-four indexed spacings from the X-ray powder pattern are listed to $d = 1.280$ Å. There are 18 weak, diffuse spacings with $d < 1.280$. The strongest spacings (for Cu/Ni radiation) are (in Å): 3.66 (10)(400), 3.54 (10)(201), 4.00 (9)(330), 3.16 (8)(231), 2.54 (7)(460), and 1.871 (6)(651, 232).

Nuffieldite was analyzed by three methods: X-ray spectrographic, electron microprobe, and a combination of colorimetry and atomic absorption spectrophotometry. In the X-ray spectrographic method atomic ratios for Bi/Pb, Pb/Cu, and Bi/Cu were determined. These ratios were then recalculated to include the necessary sulfur and to total 100.00%. The results on three samples are as follows: Pb 41.21, 40.46, 41.23; Bi 37.09, 37.89, 35.22; Cu 5.42, 5.33, 7.24; S 16.28, 16.32, 16.31%. The electron microprobe analyses (5-point analyses on each of two crystals) recast to total 100.0% gave the following averages: Pb 40.0, Bi 37.9, Cu 5.7, S 16.4%. A new colorimetric method for S was developed for sulfide samples in the 0.1–1.0 mg range. Analysis of two samples of nuffieldite (0.580 mg and 0.402 mg) gave S 16.4 and 16.3%. Two atomic absorption spectrophotometric analyses were performed on two samples of nuffieldite; one for Pb and Cu, the other for Bi. The results, Pb 40.3, Bi 37.5, and Cu 6.4 were recalculated to total 83.6% (100.0 less 16.4% S from colorimetric analysis). Thus, the results of the combination of colorimetric and atomic absorption spectrophotometric analyses are: Pb 40.0, Bi 37.2, Cu 6.4, and S 16.4%. Using all of the foregoing analytical results, "preferred" values for each element were chosen bearing in mind the limitations and degrees of accuracy for each method. The final analysis of nuffieldite is given as: Pb 40.42, Bi 37.67, Cu 5.90, S 16.35, total 100.36%. This gives an empirical formula of $Pb_{10.22}Bi_{9.45}Cu_{4.96}S_{26.73}$ or, idealized, $Pb_{10}Bi_{10}Cu_5S_{27}$. It is assumed that the excess Cu and Pb substitute for Bi. Thus, the formula derived from the analytical data and can be written: $Pb_{10.00}(Bi_{9.45}Cu_{0.87}Pb_{0.22})Cu_{7.00}$. The density calculated from this formula is 7.006 ($Z=1$) and that calculated from the ideal formula is 7.041. These compare favorably with the measured density of 7.01 ± 0.07 .

The name is for Prof. E. W. Nuffield, University of Toronto. The mineral and name were approved before publication by the Commission on New Minerals and Mineral Names, IMA.

DISCUSSION.—No mention is made of where type material is preserved.

J. A. Mandarino

Balavinskite

YA. YA. YARZHESKII (1966) *Microscopic study of Halogen Rocks*. Akad. Nauk SSSR, Sibirsk. Otdel. Vses. Nauch.-Issled. Inst. Galurgii, Izd. Nauka, Novosibirsk, 64 p. (in Russian).

A table of optical data (p. 30–31) has the entry: balavinskite, $2SrO \cdot 3B_2O_3 \cdot 4H_2O$, n_s α 1.519, β 1.552, γ 1.561, $2V$ large. No other data are given.

R. C. Erd

Weloganite

ANN P. SABINA, J. L. JAMBOR AND A. G. PLANT (1968) Weloganite, a new strontium zirconium carbonate from Montreal Island, Canada. *Can. Mineral.*, 9, 468-477.

Weloganite occurs as poorly developed crystals in vugs in an alkalic sill, 5 to 10 feet thick, which has intruded Trenton limestone at St. Michel, Montreal Island, Quebec. The crystals are roughly hexagonal in outline, and the prism faces are heavily striated parallel to the base. The crystal terminations are roughly pyramidal and range from a blunt point formed by tapering of the prism faces to an abrupt flat pedion which is often wider than the main portion of the crystal. The crystals range in length from more than 3 cm to 2 mm.

The mineral is lemon-yellow to amber, luster vitreous, streak white. Basal sections of many crystals are zoned from white to various shades of yellow. Thin fragments are colorless and transparent. Weloganite has conchoidal fracture, perfect basal cleavage and a hardness of $3\frac{1}{2}$. The specific gravity is 3.22 ± 0.03 (by suspension in heavy liquids). Measurements of specific gravity of 5 crystal fragments by means of the Berman balance gave 3.16 to 3.22, average 3.20.

Weloganite, in spite of its higher symmetry, is usually optically biaxial with (-) $2V$ about 15° , $\alpha = 1.558$, $\beta = 1.646$, and $\gamma = 1.648$, all ± 0.003 . The n_s are variable, and $2V$ may approach 0° .

Chemical analysis (Sr by flame photometry, Zr by electron microprobe) of a sample gave: SrO 41.0, ZrO₂ 19.4, CO₂ 32.2, H₂O 6.6, total 99.2%. Tests for sulfate and chlorine were negative. The analytical results recalculated to 100% give an empirical formula of Sr₇Zr₂C_{9.3}H_{6.3}O_{32.2}; the theoretical formula is given as Sr₇Zr₂C₉H₆O₃₁ or Sr₇Zr₂(CO₃)₉·4H₂O. This gives a calculated specific gravity of 3.260 (with $Z=2$) in good agreement with the measured value of 3.20. Probably the zirconium is bound in the mineral as a carbonated complex. Infrared spectrophotometry indicates the possibility of HCO₃ groups, but the results are not conclusive. Also, there may be two non-equivalent carbonate molecules in the structure. Detailed DTA and TGA studies failed to solve the problem of the structural formula of weloganite. However, small amounts of water and large amounts of CO₂ persist to relatively high temperatures.

Single crystal X-ray studies give $P3_1$ or $P3_2$ as the space group, with $a=8.96$ and $c=18.06\text{\AA}$. The X-ray powder pattern (21 indexed and 29 unindexed spacings) has the following strongest spacings (for CuK α radiation): 2.809 (10)(106), 4.35 (9)(111), 2.590 (7)(300), 2.227 (7)(117, 221), and 2.009 (7)(009), all in \AA .

Specimens are preserved in the National Mineral Collection, Ottawa. The name is in honor of Sir William E. Logan, first director of the Geological Survey of Canada. The name was approved before publication by the Commission on New Minerals and Mineral Names, IMA.

J. A. Mandarino

Bukovskyite

FRANTISEK NOVAK, PAVEL POVONDRA, AND JIRI VTELENSKY (1967) Bukovskyite, Fe₂⁺³·(AsO₄)(SO₄)(OH)·7H₂O, from Kank near Kutna Hora—a new mineral: *Acta Univ. Carolinae, Geol.* 4, 297-325.

Three analyses by Povondra gave, resp. Fe₂O₃ 31.40, 30.71, 32.42; Al₂O₃ 1.43, —, —; SO₃ 14.69, 15.68, 16.50; As₂O₅ 22.10, 21.62, 22.10; H₂O 29.41, 31.61, 28.12; SiO₂ 0.90, —, —; MgO 0.11, —, —; CaO 0.17, —, —; sum 100.21, 99.62, 99.32% corresponding to the formula above. The mineral loses 30.1% weight to 350° (probably H₂O) and 15.3% additional at 630-760° (probably SO₃). DTA curves show a large endothermic

break at 130° with a smaller shoulder at 180°; exothermal breaks at 615–630° and 645–660°, and a large endothermal break at 725°. The mineral is readily soluble in HCl.

X-ray powder data are given (57 lines); the strongest lines for 2 specimens are 9.56, 9.60 (10); 9.16, 9.21 (10); 8.84 (5, 8); 5.30 (6, 8); 4.667 (3, 7); 4.583 (3); 4.607 (7); 4.458 (6); 4.480 (9); 3.897 (7); 3.914 (9); 3.660 (6); 3.679 (8); 3.587 (7); 3.601 (9); 3.312 (5); 3.318 (8).

The mineral consists of pale yellowish-green to grayish-green microcrystalline aggregates of needles averaging 0.05×0.007 mm in size, apparently monoclinic. *ns* determined by E. Fediukova were β' 1.582, γ' 1.6305, birefringence > 0.056 , extinction angle 22°; determined by F. Ulrich in 1930, β' 1.570, γ' 1.626, birefringence > 0.049 , extinction angle 18°. Optical sign not stated. *G.* (pycnometer) 2.334, 2.34 determined (by Bukovsky in 1915). Infra-red absorption curves are given.

The mineral has long been known as an alteration product of arsenopyrite on the old dumps at Kutna Hora, Czechoslovakia. It was called "arsendestinezite" by Ulrich in 1930; that name is now abandoned for bukovskiyte, for Professor Antonin Bukovsky (1865–1950) of the secondary school at Kutna Hora, who had studied the mineral more than 50 years ago.

The name was approved before publication by the Commission on New Minerals and Mineral Names, IMA.

DISCUSSION.—Differs from sarmientite [*Amer. Mineral.* 27, 333 (1942)], which contains 2 H₂O less and has much higher *ns* and a different X-ray pattern. Similar in composition to some samples of pitticite, which is isotropic and amorphous to X-rays.

Bannisterite

MARIE LINDBERG SMITH, AND CLIFFORD FRONDEL (1968) The related layered minerals ganophyllite, bannisterite, and stilpnomelane: *Mineralog. Mag.*, 36, 893–913.

It is shown that material from Benallt Mine, Wales, and Franklin, N. J., described as ganophyllite contains a second, very similar mineral, here named bannisterite, which differs in unit cell and optical orientation. It also occurs at the Ananai Mine, Kochi, Japan. True ganophyllite has space group $A2/a$, $a = 16.60$, $b = 27.04$, $c = 50.34A.$, $\beta = 94^\circ 10'$; bannisterite has space group $A2/a$, $a = 22.20$, $b = 16.32$, $c = 24.70$, $\beta = 94^\circ 20'$. The strongest X-ray lines for bannisterite are 12.33 (100)(002), 4.593 (10)(22 $\bar{4}$), 4.103 b (15)(006), 3.077 (12)(20 $\bar{8}$), 2.638 (15)(3.6.12), 2.606 (11)(60 $\bar{8}$), 2.410 (10)(3.10.0).

Chemical analysis of bannisterite from Franklin by J. Ito gave SiO₂ 39.67, Al₂O₃ 7.95, Fe₂O₃ 0.90, MgO 0.20, MnO 35.15, CaO 1.11, PbO 0.20, Na₂O 2.18, K₂O 2.70, H₂O 9.79, sum 99.85%. *G.* 2.84. Bannisterite is optically biaxial, negative, 2*V* small to medium, *ns* are given for 4 samples; the extremes are $\alpha = 1.544$, 1.574; $\beta = 1.586$, 1.611; $\gamma = 1.589$, 1.612. Pleochroic *X* nearly colorless, *Y* and *Z* pale yellow to brown, $Y = b$, *Z* nearly $= a$ (for ganophyllite, $Z = b$, *Y* nearly $= a$).

The name is for Frederick A. Bannister, formerly keeper of Minerals, British Museum of Natural History. The mineral and the name were approved before publication by the Commission on New Minerals and Mineral Names, IMA.

Joesmithite

PAUL B. MOORE (1968) Joesmithite, a new amphibole-like mineral from Långban. *Arkiv Min. Geol.* 4, 487–492; P. B. MOORE (1968) The crystal structure of joesmithite; a preliminary note. *Mineralog. Mag.* 36, 876–879.

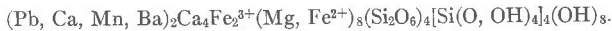
About two dozen specimens in the Långban collection of the Swedish Natural History Museum are labelled "Flink unknown No. 101" or "mineral resembling pinakiolite."

This new mineral occurs generously as the last mineral to crystallize in a hematite-magnetite-schefferite skarn assemblage, lining cavities and wholly enclosed in younger calcite. The monoclinic crystals, some fully terminated and with symmetry $2/m$, are prismatic and show the forms {010}, {100}, {110}, {011}, {112} and {113}. {110} cleavage is perfect, $H = 5\frac{1}{2}$, streak pale brown, $\rho = 3.83 \pm 0.01$ g/cc. $2V$ large (+), $\alpha = 1.747 \pm 0.005$, $\beta = 1.765 \pm 0.005$, $\gamma = 1.78 \pm 0.01$, absorption $Y > X, Z$ with Y brown with an olive tint and X, Z brown. Optic orientation not reported.

Analysis by emission spectrography by Benita Rajandi, supplemented by determination of water and of oxidation grades by A. Parwel, leads to the formula



or



Structure cell data based on single crystal X-ray observations plus powder data are: $a = 9.88 \pm 0.02$, $b = 17.87 \pm 0.02$, $c = 5.227 \pm 0.005$ Å, $\beta = 105^\circ 40' \pm 10'$, space group $P2/a$ $Z = 2$. The seven most prominent lines in the indexed X-ray powder pattern are: 3.33 (10), 2.564 (6), 2.530 (6), 2.740 ($5\frac{1}{2}$), 3.70 (5), 2.903 (5), 2.676 (5).

The mineral is named in honor of Professor Joseph V. Smith of the University of Chicago. The name was approved before publication by the IMA Commission on New Minerals and New Mineral Names.

A. Pabst

Krinovite

EDWARD OLSEN, AND LOUIS FUCHS (1968) Krinovite, $\text{NaMg}_2\text{CrSi}_3\text{O}_{10}$: a new meteorite mineral. *Science* **161**, 786-787.

Electron microprobe analyses by E. Olsen and I. S. McCallum gave SiO_2 48.1 ± 0.7 , TiO_2 0.5 ± 0.1 , Al_2O_3 0.6 ± 0.1 , Cr_2O_3 19.1 ± 0.5 , FeO 1.8 ± 0.04 , MgO 19.7 ± 0.4 , MnO 0.1 ± 0.007 , CaO 0.1 ± 0.01 , Na_2O 9.1 ± 0.5 , K_2O none, sum 99.1%, corresponding to the formula above. Attempts at synthesis failed. When heated at 1000° in air or in vacuo, the mineral lost its color; olivine (in air), magnesiochromite, cristobalite, and unidentified phases were formed.

Weissenberg study showed the mineral to be monoclinic, $a = 19.48 \pm 0.04$, $b = 29.18 \pm 0.06$, $c = 10.25 \pm 0.02$ Å, $\beta = 103 \pm 2^\circ$. The space group could not be determined because of twinning. The strongest X-ray lines (43 listed) are 7.92 (60), 7.27 (50), 4.130 (50), 3.639 (60), 3.104 (60), 2.893 (80), 2.655 (90), 2.501 (100), 2.080 (70), 2.049 (60), 1.969 (50), 1.598 (50), 1.470 (50), 1.456 (50), 1.448 (50).

The krinovite is deep emerald green. H . 5.5-7, 6.3.38 (measured, sink-float), 3.44 calcd. for $Z = 32$. No cleavage was observed. Optically biaxial, positive, n_s (Na), $\alpha = 1.712 \pm 0.002$, $\beta = 1.725 \pm 0.002$, $\gamma = 1.760 \pm 0.005$, $2V = 61 \pm 2^\circ$ measured, 64° calcd. Optic axial plane is parallel to b . Pleochroism intense, $X = b$, yellow green, Y blue-green, Z greenish-black (sometimes anomalous dark reddish-brown).

The mineral occurs as minute subhedral grains (largest approx. 200 microns) disseminated within graphite nodules in the octahedrite meteorites Canyon Diablo, Wichita County, and Youndeggin. Associated minerals in the first 2 include roedderite, high albite, and richterite; also ureyite and chromite in Canyon Diablo, and olivine (Fo 99) in Wichita County.

The name (pronounced kreen'-off-ite) is for E. I. Krinov, noted Russian investigator of meteorites. The mineral and name were approved before publication by the Commission on New Minerals and Mineral Names, IMA.

NEW DATA

Perryite

S. J. B. REED, (1968) Perryite in the Kota-Kota and South Oman enstatite chondrites. *Mineralog. Mag.* 36, 850–854.

Microprobe analyses gave for perryite from Kota-Kota and South Onan, resp., Ni 81.0, 75.5, Fe 4.0, 6.3; Si 12.4, 15.0; P 3.5, 2.4, sum 100.9, 99.2%, corresponding to $(\text{Ni}_{1.90}\text{Fe}_{0.1})$ $(\text{Si}_{0.61}\text{P}_{0.16})$ and $(\text{Ni}_{1.84}, \text{Fe}_{0.16})(\text{Si}_{0.76}\text{P}_{0.11})$. The formula is therefore $(\text{Ni}, \text{Fe})(\text{Si}, \text{P})_2$ with a deficiency in Si+P. X-ray study is in progress.

DISCUSSION.—Previous inadequate data were abstracted in *Amer. Mineral.* 52, 559 (1967). The validity of the mineral is confirmed.

Lillianite

V. A. KLYAKHIN AND M. T. DMITRIEVA (1968) New data on synthetic and natural lillianite. *Dokl. Akad. Nauk SSSR* 178, 173–175 [in Russian].

H. H. OTTO AND H. STRUNZ (1968) Zur Kristallchemie synthetischer Blei-Wismut Speissglanze: *Neues Jahrb. Mineral., Abhandl.* 108, 1–19.

Lillianite, described by Keller in 1889 as $\text{Pb}_2\text{Bi}_2\text{S}_6$, has had a complex history [see *Amer. Mineral.* 25, 726–734 (1940); 47, 811 (1962), 50, 811 (1965)]. Some of the material studied has been found to be mixtures, but natural material of this composition has been repeatedly described; unfortunately the X-ray data have not been in agreement.

Klyakhin and Dmitrieva have obtained crystals of lillianite by a hydrothermal method. Analysis gave the formula $\text{Pb}_{2.98}\text{Bi}_{2.98}\text{S}_{6.98}$, $\rho = 7.06\text{--}7.14$. Single crystal study showed it to be orthorhombic, a 13.5 ± 0.1 , b 20.7 ± 0.1 , c 4.15 ± 0.05 kX, $\rho(\text{calc})$ 7.09. The strongest X-ray lines are 3.52 (10), 3.41 (8), 3.02 (7), 2.92 (9), 2.78 (6), 2.16 (9), 2.06 (10), 1.456 (6), 1.335 (8). The natural lillianite described by Ontoev [*Dokl. Akad. Nauk SSSR* 126, 855–858 (1959)] had 3.51 (10), 3.42 (8), 3.02 (7), 2.92 (9), 2.78 (6), 2.14 (9), 2.05 (8), 1.456 (6), 1.333 (8). Otto and Strunz synthesized compounds in the system $\text{PbS-Bi}_2\text{S}_3$ by melting in sealed tubes. They postulate isomorphous replacement of 3Pb^{2+} by 2Bi^{3+} , leaving a cation vacancy. Crystals of their phase III (10 forms) were orthorhombic space group probably a 13.522, b 20.608, c 4.112Å. Partial analysis led to the formula $\text{Pb}_{2.82}\text{Bi}_{2.12}\text{S}_6$, $\rho(\text{meas})$ 7.0 ± 0.05 , $\rho(\text{calc})$ 7.07. The strongest X-ray lines are 3.523 (10), 3.419 (7), 3.005 (6), 2.913 (8), 2.778 (6), 2.156 (5), 2.070 (6), 1.777 (7).

Another phase (II) had composition $\text{Pb}_{6.46}\text{Bi}_{2.86}\text{S}_9$. It was orthorhombic a 13.70, b 31.36, c 4.14Å. This might be identical with the tabular “lillianite” described by Syritso and Senderova [*Amer. Mineral.*, 50, 811 (1965)].

DISCUSSION.—The data in the two papers on synthetic material confirm the validity of the natural mineral described by Ontoev (1959). The name lillianite should be transferred to this. There are apparently other valid Pb-Si sulfides; these require further study.

Kobellite

See abstract on tintinaite in this issue.

Unnamed Fe-Ti oxide

PAUL R. VAN LOAN (1968) A new iron-titanium oxide mineral from Hearst, Ontario (abstr.) *Can. Mineral.*, 9, 581.

The first report of this mineral was abstracted earlier [see *Amer. Mineral.*, 52, 1580 (1967)]. New data given include the results of single crystal X-ray and electron diffraction studies. The mineral is hexagonal with space group $P6_322$, $a = 2.892 \pm 0.002$, $c = 4.604$

$\pm 0.002 \text{ \AA}$, $V = 33.53 \text{ \AA}^3$. From these data, the composition ($\text{Fe}_2\text{O}_3 \cdot 3\text{TiO}_2 \cdot 0.6\text{H}_2\text{O}$), and the specific gravity (4.03 ± 0.02), $Z = 0.203$. Single crystal X-ray photographs show extra reflections and prominent arcs and streaks indicating disorder and possible existence of a superstructure.

Electron microscopy and diffraction confirm that the mineral grains consist of a single phase. Infrared spectra are distinct from those of ilmenite, hematite, anatase, and rutile, though fairly similar to that of rutile. The X-ray powder pattern is similar to, but distinct from mixtures of hematite, ilmenite, and rutile. DTA shows no prominent thermal effects up to 1100°C .

The composition and unit cell parameters are almost identical with those of "proarizonite" [see *Amer. Mineral.*, **49**, 1774 (1964)] and "pseudorutile" [see *Amer. Mineral.*, **52**, 299 (1967)].

DISCUSSION.—The problem of an acceptable name has been referred to the Commission on New Minerals and Mineral Names, IMA.

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