

## NEW MINERAL NAMES

MICHAEL FLEISCHER

### Hemusite

- G. TERZIEV (1965) *Spisanie Bulgar Geol. Druzhestvo* **26**, 375-381; also *Geol. Rudnykh Mestorozhd.* **1966**, 37-48 (1966); from abstract by E. M. Bohnstedt-Kupletskaya, *Zap. Vses. Mineral. Obshch.* **97**, 67 (1968).

A mineral,  $Cu_2SnS_4$ , occurring as an accessory in the Cu-As deposit at Chelopech, Bulgaria. No data given.

### Chalcothallite

- E. I. SEMENOV, H. SØRENSEN, M. S. BESSMERTNAYA, AND L. E. NOVOROSSOVA (1967) Chalcothallite, a new sulphide of copper and thallium from the Ilimaussaq intrusion, South Greenland. *Medd. Grønland* **181**, no. 5, p. 13-26.

Analysis by L. E. N. gave Tl 38.07, Cu 40.58, Ag 0.19, Pb 0.13, Fe 3.79, S 12.06, Sb 3.93, insol. 1.52, total 100.27%. Sometimes contains Au, As, Bi. This corresponds to  $Cu_2TlS_2$  or  $3Cu_2S \cdot Tl_2S$ . Synthetic material of this composition was homogeneous and resembled the natural mineral in optical properties (not stated whether the X-ray data agree—M.F.).

X-ray powder data (by V. S. Lebedev) are given; strongest of the 29 lines are 3.93 (4), 3.07 (10), 2.48 (9), 1.930 (4).

The mineral forms lamellar aggregates up to  $3 \times 2 \times 0.5$  cm. in ussingite. Color lead-gray to iron-black, streak black, luster metallic. Cleavage in 3 mutually perpendicular directions; that parallel to the laminae is perfect, the others good or fair. Easily splits into very fine flakes or rectangular plates. Tarnishes iridescent. *G.* 6.6, *H.* 61-90 kg/sq. mm. (= 2-2.5 Mohs). Polysynthetic twinning was noted under the microscope.

Color in reflected light light gray; adjacent to chalcocite shows a slight pinkish-lavender tint. Reflectivity decreases from 35.4% to 440 nm to 30.5% at 540 nm and 680 at 28.9 nm. Birefringence notable in air. *R<sub>g</sub>* colorless to slightly bluish, *R<sub>p</sub>* pinkish-lavender, anisotropy distinct in orange-brown tints.

Chalcothallite alters along cleavages to native silver (perhaps containing Tl), chalcocite, vrbaite, and avicennite (?).

The mineral occurs in veins of ussingite cutting poikilitic sodalite syenite at Nakalaq, Ilimaussaq massif, Greenland. Associated minerals include chkalovite, epistolite, niobophyllite, analcime, natrolite, microcline, Li-mica, tugtupite, galena, sphalerite, and molybdenite.

The name is for the composition.

### Stibiodufrenoyite (=Veenite), Unnamed sulfosalts

- I. BURKART-BAUMANN, J. OTTEMANN AND G. C. AMSTUTZ (1966) Neue Beobachtungen an den röntgen-amorphen Sulfiden von Cerro de Pasco, Peru. *Neues Jahrb. Mineral., Monatsh.*, no. 12, 353-361.

Lead-gray botryoidal coatings on pyrite-marcasite and sphalerite-wurtzite from Cerro de Pasco have been described as Pb-As sulfides that are amorphous to X-radiation. Now another such Pb-As sulfide glass is described in gratonite. The material has botryoidal structure and shows zoning. Reflectivity lies below that of galena, about equal to that of dufrenoyite-baumhauerite. Reflection colors range between green-white and yellow-white tints, depending on the zone. Pb, Sb, As and S determined by electron microprobe. Strongest lines of the X-ray diffraction powder pattern (given without indices and in-

tensities) are 4.26<sub>6</sub>, 3.75, 3.38<sub>3</sub>, 3.21<sub>5</sub>, 3.00<sub>2</sub>, 2.89<sub>7</sub>, 2.71<sub>5</sub>, 2.36<sub>0</sub>. On the basis of these data the authors conclude the material is a new mineral, Pb<sub>2</sub>(Sb,As)<sub>2</sub>S<sub>6</sub>, with Sb dominant, named *stibiodufrenoyseite*.

Another phase is stated to show similarities to baumhauerite, but it is amorphous to X-rays. The evidence for this phase is scanty. In order to prove the existence of such a phase it was synthesized from a dry melt. A miscibility-gap in the system Pb-As-S was encountered between 464° and 900°C (the limit of experiments so far) with compositions (As<sub>2</sub>S<sub>3</sub>)<sub>55</sub>(PbS)<sub>45</sub> and (As<sub>2</sub>S<sub>3</sub>)<sub>90</sub>(PbS)<sub>10</sub>, where the subscripts are in weight percent. The natural glass was converted to baumhauerite by heating at 310°C ± 5° for three months *in vacuo* and quenching in water. The strongest lines of the X-ray diffraction powder pattern, unindexed and lacking intensity-designations, are 4.10, 3.56, 3.40, 2.98, 2.92, 2.85, 2.75, 2.33, 2.08.

A new crystalline phase with optical properties unlike those of the sulfosalts occurs in a specimen of gratonite from the same locality. The phase occurs as tufted feathery aggregates on pyrite-marcasite. Single crystals with pseudo-hexagonal cross-section occur in amorphous matrix. Etching indicates homogeneity. The reflectivity of the crystals resembles that of the surrounding matrix of amorphous baumhauerite. Reflection-pleochroism in oil ranges from greenish white to yellowish white; anisotropism is distinct with crossed nicols. On the basis of electron microprobe analyses (Pb 57.9, 61.2, 60.9; As 16.8, 16.9, 14.2, Sb 0.7; S 28.2, 24.8, 27.7%) the formula Pb<sub>11</sub>As<sub>8</sub>S<sub>31</sub> is suggested. The 16 strongest lines of the X-ray diffraction powder pattern are given without indexes and intensities.

The glass-like sulfides described so far from Cerro de Pasco occur as large fairly homogeneous stalactitic and botryoidal coatings. The highest content of Pb exists in zones having the composition of dufrenoyseite, whereas the major masses consist preponderantly of material having the composition of baumhauerite. Both phases were converted to their crystalline equivalents by appropriate treatment. Substances containing less Pb than does baumhauerite were not encountered as definite phases. Botryoidal lead gray coatings that fracture in blood-red splinters therefore had special interest. In polished sections this material shows radial-concentric and dendritic form. Optical properties and deep red internal reflections suggest realgar, but the material is isotropic and amorphous to X-rays. Electron microprobe analyses indicate an As-rich phase with low (slightly more than 4 wt.%) Pb-content. Heat treatment at 300°C for three months caused the material to separate into crystals of orpiment and baumhauerite.

Two other As-sulfides that are also amorphous to X-rays have sharply-defined growth-boundaries and low contents of Pb according to analyses made by electron microprobe.

DISCUSSION.—1) *Stibiodufrenoyseite* should not have been named. It is probably identical with veenite, described by Jambor [*Can. Mineral.* 9, 7–24 (1967)]. The latter, approved by the Commission on New Minerals and Mineral Names, IMA, was submitted to the Commission early in 1966, some months before the paper under discussion, and therefore has clear priority. 2) The evidence offered for the existence of Pb<sub>11</sub>As<sub>8</sub>S<sub>31</sub> is unconvincing. 3) Preliminary descriptions with insufficient information to characterize a material serve no useful purpose. Milton and Ingram [*Amer. Mineral.*, 44, 1070–1076 (1959)] have commented on some aspects of the problem involving Pb-As-sulfide glasses.

Kurt Servos

#### Plumbozincocalcite

M. Z. KANTOR (1964) *Izvest. Vyssh. Uchebn. Zaved. Geol. Fazved.* no. 3, p. 61–69; from an abstract by E. M. Bohnstedt-Kupletskaia, *Zap. Vses. Mineral. Obsch.* 97, 70–71 (1968).

Name given to calcite from a Pb-Zn deposit in skarn, western Karamazar, that contains PbO 0.25-0.47, ZnO 0.66-0.88%.

DISCUSSION.—Unnecessary name.

### Chernovite

B. A. GOLDIN, N. P. YUSHKIN, AND M. V. FISHMAN (1967) A new yttrium mineral, chernovite. *Zap. Vses. Mineral. Obshch.*, 96, 699-704 [in Russian].

Spectrographic analysis by G. E. Yushkova gave  $Y \gg 30\%$ ,  $As \sim 30\%$ , La 0.8, Ce 0.8, P 0.6, V 0.3, Si 2.0, Ti 0.04, Mn 0.02, Pb, Cu, Cr, Sn each 0.01, Be 0.001%. X-ray spectrographic analysis of the rare earths by E. Vasil'ev gave Y 78, La and Pr none, Ce 0.4, Nd 1.6, Sm 1.1, Eu 0.2, Gd 2.2, Tb 0.6, Dy 4.2, Ho 1.4, Er 4.7, Tm 0.6, Yb 4.1, Lu 0.9, sum 100%. The mineral is essentially  $YAsO_4$ , with a small part of the As replaced by P, V, and possibly by Si. Insoluble in acids.

X-ray powder data by L. V. Shvetsova (36 lines) gave strongest lines 3.519(10)(200), 2.644(10)(112), 2.479(7)(220), 1.997(8)(103), 1.811(10)(312), 1.756(6)(400), 1.571(8)(420), 1.464(9)(332), 1.431(6)(204), 1.326(7)(224), 1.261(10)(512), 1.177(10)(404,600), 1.125(10)(532), 1.109(10)(424,620), 1.023(9)(116). These correspond fairly closely to the ASTM file no. 13-1429 for synthetic  $YAsO_4$  and are indexed on a tetragonal cell, space group  $D^{19}_{9h}-I4_1/amd$ , with  $a = 7.039 \pm 0.011$ ,  $c = 6.272 \pm 0.022$ ,  $c/a = 0.891$ ,  $Z = 4$ , G. calcd. 4.866. The mineral is therefore isostructural with xenotime and zircon.

The mineral occurs in crystals of prismatic habit, mostly about 0.25 mm long, maximum 0.65 mm long, showing forms {010}, {011}, and {001}, occasional narrow rough faces of {110}. Cleavage {010} perfect, sometimes a gliding plane on {001}, rarely on {110}. Brittle. Hardness by microsclerometer 225-429, av. 313 kg/sq mm (=4.2-4.7, av. 4.5 Mohs). Colorless to pale yellow, with color zones, luster vitreous. G. could not be measured, the mineral sinks in Clerici solution of G. 4.2. Optically uniaxial, positive,  $n_s$  (Na),  $\omega$  1.783  $\pm$  0.001,  $\epsilon$  1.879  $\pm$  0.02. Pleochroic from colorless on  $\epsilon$  to pale rose-yellow on  $\omega$ .

The mineral occurs in piemontite veinlets in liparite porphyry at the source of the Nyarta-syu-yu River, eastern Telpos-iz, near Polar Urals. Associated minerals are molybdenian scheelite, albite, calcite, garnet, hastingsite, pyrolusite, and hematite.

The name is for Professor A. A. Chernov, geologist. The mineral was approved before publication by the Commission on New Minerals and Mineral Names, IMA.

### Unnamed K-analogue of Analcime

E. I. SEMENOV, Zeolites of the Lovozero alkalic massif. In *Mineralogy of Pegmatites and Hydrothermalites of Alkalic Massifs*. Inst. Mineral., Geokhim., Kristalloghim. Redk. Elementov, Izdat. "Nauka," Moscow, 1967, p. 14-29 (in Russian).

Analyses from Chivruai River by T. A. Kapitonova and from Lyzvaiok River, by I. S. Razina gave, resp.  $SiO_2$  54.77, 52.81;  $Al_2O_3$  23.55, 23.43;  $Fe_2O_3$  0.36, 0.42;  $MgO$  0.67, 0.91;  $CaO$  0.93, 1.25;  $Na_2O$  4.46, 4.45;  $K_2O$  8.30, 9.64;  $H_2O^+$  4.93, 5.93;  $H_2O^-$  1.83, 1.34, sum 99.80, 100.18%. Flame photometric analysis showed  $Rb_2O$  0.006%, and spectrographic analysis 0.00x% of Ti, Mn, Sr, Zr, and Be. These analyses correspond to  $(K,Na)AlSi_2O_6 \cdot H_2O$ . A DTA curve (N. Solov'eva) shows an endothermic break at 370°. A dehydration curve shows gradual loss of water (about 2% at 175°, 4% at 250°, more than 6% at 400°, about 8% at 600°).

The mineral is yellowish-white, fracture porcelain-like, fine-grained. G. 2.2. Under the microscope weakly polarizing, average  $n$  1.505. The x-ray powder photograph differs from that of analcime and somewhat resembles those of microcline and of synthetic "phase M" ( $K_2Al_2Si_3O_{10} \cdot 3H_2O$ ) of Barrer and White. The strongest lines (30 given) are 6.82 (6), 6.10 (10), 4.41 (10), 2.94 (9.5), 2.61 (7.5), 2.18 (7.5), 1.805 (7.5).

The mineral occurs in zones of hydrothermal alteration of nepheline syenites, Chivruai River, Lovozero Massif, and Lyavaiok River, Khibina massif, Kola Peninsula, in cryptocrystalline, irregular masses up to 2 cm. It is associated with quartz, albite, and hydro-muscovite, and is considered to be of low-temperature hydrothermal origin.

The mineral is considered to be probably a new species, but is not named, pending further study.

#### Chlor-hastingsite

G. A. KRUTOV AND RAVINDRADOVA (1966) Chlor-hastingsite from the Odinochnoe deposit, Eastern Sayan. *Dokl. Akad. Nauk SSSR* 169, 204-206.

Analyses showed up to 2% Cl in these amphiboles.

DISCUSSION.—An unnecessary name.

#### Hydro-naujakasite

OLE V. PETERSEN (1967) The mineralogy of naujakasite. *Medd. Grønland* 181, no. 6, p. 1-17

The name is given to a group of alteration products of naujakasite, a detailed description of which will be published later. Monoclinic. Optically biaxial, positive,  $n_s$  (Na)  $\alpha$ 1.528,  $\beta$ 1.529,  $\gamma$ 1.531, all  $\pm$ 0.002.

DISCUSSION.—The name should not have been used without a description.

### NEW DATA

#### Jalpaite

Z. JOHAN (1967) Etude de la jalpaite,  $Ag_{1.55}Cu_{0.45}S$ . *Acta Univ. Carolinae, Geol.*, No. 2, 113-122.

Jalpaite was found in a calcite-(quartz) ore vein at Bohutín, near Píbram, Bohemia, Czechoslovakia. It is associated with chalcopyrite, tetrahedrite, galena, silver natif, and is intimately intergrown with argentite. It occurs as foliated or irregularly grained masses.

The mineral is gray on fresh fracture, with a metallic luster, tarnishes soon to dark color, and finally becomes nearly black. Malleable. Streak black. Hardness  $2-2\frac{1}{2}$ , good prismatic cleavage.

In reflected light, jalpaite is light gray, with a bluish tint. Reflectivity: 33.5% (green light), 31.0% (orange light), and 27.5% (red light). The anisotropy is weak. No birefringence and internal reflections could be observed. Diagnostic etching:  $HNO_3$ (1:1),  $FeCl_2$  (20%),  $HgCl_2$  (5%) positive;  $HCl$  (1:1) positive (negative);  $KOH$  (40%) negative.

Chemical analysis of the mixture of jalpaite+argentite ( $G=6.96$ ) gave Ag 77.15, Cu 8.85, S 13.65, sum 99.65%. From this analysis the author assumes that the relation jalpaite: argentite was (in %) 70.52:29.48.

Jalpaite is tetragonal, with  $a=8.692\pm 0.009$ ,  $c=11.76\pm 0.02$  Å,  $c:a=1.353$ ,  $Z=16$ . X-ray powder data are given (34 lines); the strongest lines are (in Å): 2.359 (10) (321), 2.814 (9) (301), 2.759 (8) (213), 2.436 (7) (204), 2.124 (6-7) (224), 4.353 (6) (200), and 2.014 (5-6) (215).  $G$ (calc.) 6.771. The X-ray powder diagram of jalpaite from Bohutín is identical with those of jalpaite from the type locality at Jalpa, Mexico, and of the synthetic phase  $Ag_{1.55}Cu_{0.45}S$ .

NOTE.—The type material of jalpaite from Jalpa, Mexico, deposited with the Mineralogical collection of the Mining Institute in Freiberg (Saxony), represents virtually a mixture of two distinct phases of the ternary system Ag-Cu-S. The first phase belongs to the true jalpaite ( $Ag_{1.55}Cu_{0.45}S$ ), the second one is identical with mckinstryite ( $Ag_{1.2}Cu_{0.8}S$ ).

F. Čech

## Delafossite

H. WIEDERSICH, J. W. SAVAGE, A. H. MUIR, JR., AND D. C. SWARTHOUT (1968) On the composition of delafossite. *Mineralog. Mag.* **36**, 643–650.

M. H. HEY (1968) On the composition of natural delafossite. *Mineralog. Mag.* **36**, 651–653.

Buist, Gadalla, and White reported [*Mineralog. Mag.*, **35**, 731–741 (1966)] that they were unable to prepare a compound of formula  $\text{CuFeO}_2$ , and they suggested that delafossite has the formula  $\text{Cu}_6\text{Fe}_3\text{O}_7$ .

Wiedersich *et al.* now report syntheses in the system Cu-Fe-O, with chemical, X-ray, and Mossbauer data. The only compound formed was  $\text{CuFeO}_2$  with X-ray pattern identical with that of delafossite. Hey gives two new microchemical analyses of natural delafossite + kaolinite (one from the type locality); these also indicate the formula  $\text{CuFeO}_2$ .

## Retzian, Hemafibrite, Synadelphite, Arsenoclasite, Arseniolepte, and Akrochordite

PAUL B. MOORE (1967) Contributions to Swedish Mineralogy. I. Studies on the basic arsenates of manganese: retzian, hemafibrite, synadelphite, arsenoclasite, arseniolepte, and akrochordite. *Ark. Mineral. Geol.* **4**, 425–444.

Retzian, tentatively  $\text{Mn}_2\text{Y}(\text{AsO}_4)(\text{OH})_4$ , with  $a=5.67$ ,  $b=12.03$ ,  $c=4.863$  Å,  $Z=4$ , space group *Pbn*, appears to be related to flinkite.

Hemafibrite,  $\text{Mn}_3(\text{AsO}_4)(\text{OH})_3(\text{H}_2\text{O})$ ,  $a=9.87$ ,  $b=10.73$ ,  $c=18.84$  Å,  $Z=12$ , space group *Pbnm* or *Pbn2<sub>1</sub>*, is a variety of synadelphite.

Arsenoclasite,  $\text{Mn}_5(\text{AsO}_4)_2(\text{OH})_4$ , has  $a=9.31$ ,  $b=5.75$ ,  $c=18.84$  Å,  $Z=4$ , the space group is *P2<sub>1</sub>2<sub>1</sub>2<sub>1</sub>*.

Arseniolepte,  $(\text{H}_3\text{O}^+, \text{Ca}, \text{Mg}, \text{Pb})_{8.42}(\text{Mn}, \text{Fe}^{+3}, \text{Mg})_{12}((\text{As}, \text{H}_4)\text{O}_4)_{12}$ .  $a=11.31$ ,  $b=13.06$ ,  $c=6.86$ ,  $99^\circ$ ,  $Z=1$ , space group *P2<sub>1</sub>/c*, is a water-rich variety of caryinite.

Akrochordite,  $\text{Mn}_4\text{Mg}(\text{AsO}_4)_2(\text{OH})_4 \cdot 4\text{H}_2\text{O}$ , has  $a=5.70$ ,  $b=17.60$ ,  $c=6.752$  Å,  $99^\circ 48'$ ,  $Z=2$ , and space group *P2<sub>1</sub>/c*.

Indexed X-ray powder diffraction patterns are presented for all of these minerals.

A. Pabst

## Melanostibian and Lamprostibian renamed Melanostibite; Manganostibite; Ferrostibian = Långbanite

PAUL B. MOORE (1967) Contributions to Swedish mineralogy. II. Melanostibite and manganostibite, two unusual antimony minerals. The identity of ferrostibian with långbanite. *Ark. Mineral. Geol.*, **4**, (nr. 23) 449–458.

Type specimens of melanostibian and lamprostibian from the Sjö mine, Grythyttan, have been reexamined and found to be variants of one mineral which is renamed melanostibite. Its composition, based on microprobe analysis, is  $\text{Mn}(\text{Sb}_{0.8}\text{Fe}_{0.5})\text{O}_3$ . It belongs to the ilmenite series with cell dimensions  $a_b=5.226$ ,  $c_b=14.325$ ,  $Z=6$ . If Sb and Fe are disordered the space group is *R $\bar{3}$* , if they are ordered it must be *R3*.

Manganostibite from the type locality, the Moss mine, Nordmark, has been analyzed by microprobe. Assigning valences to preserve charge balance, this leads to the formula:— $(\text{Mn}^{2+}_{4.8}\text{Mn}^{4+}_{2.0}\text{Fe}^{3+}_{0.7}\text{Zn}_{0.4})\text{Mn}^{4+}_{16}(\text{Sb}^{5+}_{2.4}\text{Mg}_{1.9})(\text{Sb}^{5+}_{2.0}\text{As}^{5+}_{1.1}\text{Si}_{0.8})\text{O}_{59.8}$  for the cell content. The cell dimensions are  $a=8.72$ ,  $b=18.86$ ,  $c=6.06$  Å, space group *Ibmm* or *Ib2m*.

Ferrostibian from the Sjö mine, the type locality, is shown to be identical with långbanite.

Indexed X-ray powder patterns are presented for all of these minerals.

A. Pabst

## Tundrite, Tundrite—(Nd)

E. I. SEMENOV, M. E. KAZAKOVA, AND R. A. ALEKSANDROVA (1967) The Lovozero minerals nenadkevichite, gerasimovskite, and tundrite, from Ilimaussaq, South Greenland. *Medd. Grønland* **181**, no. 5, p. 1–11.

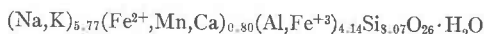
Two new analyses of tundrite from this new locality: by M.E.K. gave SiO<sub>2</sub> 10.15, 10.98; TiO<sub>2</sub> 10.14, 11.21; Nb<sub>2</sub>O<sub>5</sub> 4.26, 6.09; TR<sub>2</sub>O<sub>3</sub> 49.92, 48.78; Fe<sub>2</sub>O<sub>3</sub> 0.46, 1.00; CaO 0.74, 0.97; Na<sub>2</sub>O 6.28 (7.08 by diff.), K<sub>2</sub>O 1.31,—; H<sub>3</sub>O<sup>+</sup> 13.37, 13.65; H<sub>2</sub>O<sup>-</sup> 1.48, 0.24; ThO<sub>2</sub> 0.70,—; sum 98.78 (100)%. G. 4.02, *ns*  $\alpha$  1.731,  $\gamma > 1.88$ . The rare earths ( $\sum$  RE = 100) were, resp.: La 24, Ce 55, Pr 6.5, Nd 15, Sm 0.3, and La<sub>24</sub>, Ce 7.5, Pr 12, Nd 45, Sm 6.6, Eu 0.1, Gd 4, Tb 0.3, Dy 0.5. The former is therefore normal tundrite (tundrite—Ce), the latter is tundrite-(Nd), in the nomenclature of Levinson [*Amer. Mineral.* **51**, 152–158 (1966)].

The new analyses differ from the previous ones [*Amer. Mineral.* **47**, 419–420 (1961) **50**, 2097–2098 (1965)] in high sodium content. The new formulas are Na<sub>2</sub>Ce<sub>2</sub>(Ti,Nb)SiO<sub>8</sub>·4H<sub>2</sub>O (*Z* = 2) or Na<sub>3</sub>Ce<sub>3</sub>(Ti,Nb)<sub>2</sub>Si<sub>2</sub>O<sub>14</sub>·8H<sub>2</sub>O (*Z* = 1). X-ray study by A. A. Voronkov gave: triclinic, *a* 7.54, *b* 13.98, *c* 5.02Å.,  $\alpha$  101°30',  $\beta$  70°25',  $\gamma$  101°30', nearly the same as the previous data (but in a different setting—M.F.)

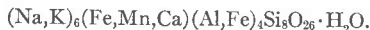
## Naujakasite

OLE, V. PETERSEN (1967) The mineralogy of naujakasite. *Grønland* **181**, no. 6, p. 1–17.

Naujakasite was described in 1933 by Bøggild [abstr. *Amer. Mineral.* **20**, 138 (1935)]. Type material has been re-examined. Chemical analysis by Ib Sørensen gave SiO<sub>2</sub> 51.28, TiO<sub>2</sub> 0.03, Al<sub>2</sub>O<sub>3</sub> 20.90, Fe<sub>2</sub>O<sub>3</sub> (total iron) 7.23, MnO 1.11 CaO 0.2–0.4, Na<sub>2</sub>O 18.60, K<sub>2</sub>O 0.50, P<sub>2</sub>O<sub>5</sub> 0.07, total 99.92 100.12%. FeO and H<sub>2</sub>O could not be determined on the small amount of pure material available; a TGA curve showed gradual loss of water totalling 1.71% up to 500°. From the decrease in weight found at 750–900°, the iron is calculated as Fe<sub>2</sub>O<sub>3</sub> 2.18, FeO 4.46%. The sample had been purified by hand picking, magnetic separation, and heavy liquid treatment, but still contained a very small amount of arfvedsonite and some analcite, “almost certainly much less than 10%.” The analysis leads to the formula:



or



X-ray study shows the mineral to be monoclinic, space group *C2/m*, *Cm*, or *C2*, *a* 15.039 ± 0.002, *b* 7.991 ± 0.001, *c* 10.487 ± 0.002Å.,  $\beta$  113.67 ± 0.02°, *Z* = 2, *G* (calc) 2.661, (meas) 2.622. Cleavages {001} micaceous, { $\bar{4}01$ } and {010} distinct.

The strongest X-ray lines (36 given) are 7.11 (5) (201), 6.88 (5) (200), 4.23 (5) ( $\bar{3}11$ ), 3.99 (10) (020), 3.98 (5) (3.10), 3.69 (6) (021), 3.62 (5) (112), 3.56 (7) ( $\bar{4}02$ ), 3.44 (6) (400), 3.12 (5) ( $\bar{2}22$ ), 3.06 (6B) (221), 2.79 (6) ( $\bar{5}11$ ), 2.65 (5) ( $\bar{4}22$ ), 2.61 (6) (420), 2.49 (5) ( $\bar{4}04$ ), 2.26 (7) ( $\bar{3}32$ ).

Crystals are platy, with diameter 1–5 mm., thickness less than 1 mm. Gray to silver-white, luster pearly on basal plane. Optically biaxial, negative, *ns* (Na) (universal stage),  $\alpha$  1.537,  $\beta$  1.551–1.549,  $\gamma$  1.556 (all ± 0.001), 2*V* (meas) 52–71°, (calc) 62–75°.