

NEW MINERAL NAMES

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Talnakhite

- I. A. BUD'KO, AND E. A. KULAGOV (1963) Natural cubic chalcopyrite. *Dokl. Akad. Nauk SSSR*, **152**, 408-410 [in Russian].
- L. J. CABRI (1967) A new copper-iron sulfide. *Econ. Geol.* **62**, 910-925.
- I. A. BUD'KO AND E. A. KULAGOV (1968) The new mineral talnakhite, a cubic variety of chalcopyrite. *Zap. Vses. Miner. Obshch.* **97**, 63 [in Russian].

The mineral was first described by B. and K. from Noril'sk, western Siberia. It was later proved by Cabri not to be the face centered cubic high-temperature polymorph of chalcopyrite, but to have the composition $\text{Cu}_{18}(\text{Fe}, \text{Ni})_{18}\text{S}_{32}$, electron probe analysis giving Cu 36.1, Fe 31.6, Ni 0.7 S 31.9 sum, 100.3 percent. Cabri reports it to be cubic, space group probably $I\bar{4}3m$ but possibly $Im\bar{3}m$ or $I\bar{4}3$; a 10.64₈Å. The strongest lines are 7.52 (3) (110), 3.75(4) (220), 3.043(10) (222), 2.656(5) (400), 1.879(9) (440), 1.598(7) (622), 1.327(4) (800), 1.210(5) (662). (calc) 4.36, measured 4.24. At 80-100° the mineral decomposes to tetragonal cubanite+bornite

The later data of B. and K. agree with those above except that they give the unit cell as a 5.280±0.005 Å. They named the mineral talnakhite (approved by the IMA Commission on New Minerals and Mineral Names) for the Talnakh ore deposit, where it is associated with chalcopyrite, cubanite, and pentlandite.

Bohdanowiczite

- MARIAN BANAS AND JOACHIM OTTEMANN (1969) New data on bohdanowiczite. *Przeegl. Geol.* **17**, 235-238 [in Polish].

The name had been given earlier without data (*Amer. Mineral.* **53**, 2103). The mineral occurs at Kletna, Poland, in magnetite-fluorite veins and in fluorite-quartz-sulfide veins. Associated minerals are uraninite, clausthalite, chalcocite, emplectite. It is also reported to occur at Julienehaab, Greenland, where it is associated with clausthalite and bornite. The mineral shows polysynthetic twin lamellae.

Electron probe analysis gave Ag 22.6, Bi 44.7, Se 32.1, S 0.7, sum 100.1 percent, corresponding to AgBiSe_2 , the selenium analogue of matildite. X-ray data could not be obtained. It occurs in anhedral grains. Reflectivity in white light 55 percent, higher than those of clausthalite and chalcopyrite, and of matildite (40-44 percent). Anisotropy weak, but distinct, stronger in immersion oils. Hardness 96 kg/mm²=3.2 (Mohs). Birefringence difficult to observe except at grain edges.

Titanochromite

(= titanian chromite and chromian ulvöspinel)

- E. N. CAMERON (1970) Opaque minerals in lunar samples. *Science* **167**, 623-625.
- S. O. AGRELL, A. PECKETT, F. R. BOYD, S. E. HAGGERTY, T. E. BUNCH, E. N. CAMERON, M. R. DENCE, J. A. V. DOUGLAS, A. G. PLANT, R. J. TRAILL, O. B. JAMES, K. KEIL, AND M. PRINZ (1970) Titanian chromite, aluminian chromite, and chromian ulvöspinel from Apollo XI rocks. *Geochim. Cosmochim. Acta Suppl. Proc. Apollo XI Lunar Sci. Conf.* **1**, 81-86.

The second paper cited is a summary of work by 8 laboratories; it includes electron microprobe analyses of 12 samples from the moon rocks that are essentially solid solutions of chromite (FeCr_2O_4), ulvöspinel (TiFe_2O_4), and hercynite (FeAl_2O_4), with considerable

amounts of MgO. The term titanochromite, used in the first paper, is replaced in the second by the term titanian chromite; it is an unnecessary name.

Armalcolite

A. T. ANDERSON, T. E. BUNCH, E. N. CAMERON, S. E. HAGGERTY, F. R. BOYD, L. W. FINGER, O. B. JAMES, K. KEIL, M. PRINZ, P. RAMDOHR, AND A. EL GORESY (1970)
 Armalcolite: a new mineral from the Apollo XI samples. *Proc. Apollo XI Lunar Sci. Conf.*, 1, 55-63.

This is a summary report, combining the data by seven laboratories, some of which were published previously in *Science*, 167, 587, 597, 613, 617, 623, 644, Jan. 30, 1970.

Microprobe analyses of 10 grains by 6 different laboratories gave TiO₂ 70.9-75.6, Al₂O₃ 0.97-2.18, Cr₂O₃ 0.97-2.18, FeO 11.32-18.01, MnO 0.01-0.08, MgO 5.52-11.06 percent. CaO was determined in 3 samples 0.01-0.13, V₂O₅ in one as 0.07 percent. Fe₂O₃ was not determined, but must be very low since only traces were found in the rocks. The composition is (Mg, Fe) Ti₂O₆ with Mg:Fe close to 1:1, but ranging on both sides, Mg/Fe varying from 0.55 to 1.74. The mineral is a member of the pseudobrookite group; the composition showing the replacement (Mg, Fe²⁺)Ti for Fe³⁺₂. The end-members FeTi₂O₅ and MgTi₂O₅ and three intermediate compositions have been synthesized by heating the components in evacuated silica tubes at 1300°C. FeTi₂O₅ breaks down at 1140 ± 10°C to ilmenite + TiO₂.

X-ray powder data are given. The strongest lines are 3.468 (100) (101, 220), 2.763 (25) (230), 2.454 (25) (301), 1.958 (80) (430). These are indexed on a cell with *a* 9.743 ± 0.03, *b* 10.023 ± 0.02, *c* 3.738 ± 0.03 Å.

The mineral is gray, opaque. ρ (calc) 4.94. Strongly anisotropic, colors ranging from pale gray to dark bluish-gray. Reflectivities are given at δ wave lengths from 450 to 640 nm; they decrease with increasing wave length; extremes *R*₁ 14.1, 13.0; *R*₂ 15.2, 14.1 percent. Pleochroic. No internal reflections.

The mineral occurs as grains, generally rectangular in outline, with longest dimension 100-300 μ m, in rocks collected by the Apollo XI mission, at Tranquillity Base, Moon. It commonly has an overgrowth of ilmenite.

The name is for Neil A. ARMstrong, Edwin E. ALdrin, and Michael COLLins, the astronauts responsible for the collection and return of the Apollo XI samples from the moon. Type material is deposited at the Lunar Science Institute, Houston, Texas.

The mineral and name were approved in advance of publication by the Commission on New Minerals and Mineral Names, IMA.

DISCUSSION.—Here the middle range of a binary solid solution series has been named; it is more usual to name the end-members. The names "ferropseudobrookite" and "karroite" have been given to the synthetic end members FeTi₂O₅ and MgTi₂O₅ (ferropseudobrookite was used for armalcolite in the first reports), but these names have no standing in mineralogy. Nevertheless, serious problems of nomenclature may be raised if the end members are found to occur naturally.

Unnamed Ce phosphate

E. I. SEMENOV (1969) *Mineralogy of the Ilimaussaq Alkaline Massif, Southern Greenland*. Inst. Mineral., Geokhim., Kristalloghim. Redk. Elementov, Izdat. "Nauka" 1969, 164 p. [in Russian], (p. 41-42).

A white cerium phosphate was found in hydrothermal natrolite-analcime rocks, Narsak River. Analysis by G. V. Lyubomilova gave P₂O₅ 29.63, SiO₂ 1.34, TR₂O₃ 56.50, CaO 4.18, Fe₂O₃ 1.10, H₂O (by diff.) 7.24 percent. Formula (Ce, Ca, H)PO₄·H₂O. The X-ray pattern by R. A. Aleksandrova shows 8 lines (in kX): 4.41 (5), 3.08 (7), 2.82 (10), 2.16 (7), 1.875

(5), 1.707 (3), 1.316 (5), 1.269 (3). It is optically biaxial (?), sign not given, elongation negative, $ns \alpha 1.62$, $\gamma 1.64$. It forms dense microgranular deposits up to 0.1×0.5 cm, cut by veinlets of rhabdophane.

Pyroxferroite

E. C. T. CHAO, J. A. MINKIN, C. FRONDEL, C. KLEIN, JR., J. C. DRAKE, L. FUCHS, B. TANI, J. V. SMITH, A. T. ANDERSON, P. B. MOORE, G. R. ZECHMAN, JR., R. J. TRAILL, A. G. PLANT, J. A. V. DOUGLAS, AND M. R. DENCE (1970) Pyroxferroite, a new calcium-bearing iron silicate from Tranquillity Base. *Geochim. Cosmochim. Acta. Suppl. Proc. Apollo XI Lunar Sci. Conf.* 1, 65-79.

This is a summary report, combining the data by five laboratories, some of which were published previously in *Science*, 167, 501, 583, 587, 594, 644, 656, 681, Jan. 30, 1970. Five analyses by electron probe show SiO_2 44.7-47.0, TiO_2 0.2-0.7, Al_2O_3 0.0 to 1.2, FeO 44.6-47.9, MnO 0.1-1.3, MgO 0.3-1.2, CaO 5.4-6.3 percent, average $(\text{Fe}_{0.84}\text{Ca}_{0.13}\text{Mg}_{0.02}\text{Mn}_{0.02})\text{SiO}_3$, the iron analogue of pyroxmangite. The mineral, composition $(\text{Fe}_{0.85}\text{Ca}_{0.15})\text{SiO}_3$, was synthesized by Lindsley (1967) *Carnegie Inst. Wash. Year Book* 65, 230-232.

Weissenberg and precession data show the mineral to be triclinic; average of 6 determinations is a 6.62, b 7.54, c 17.35 Å., α 114.4, β 82.7, γ 94.5°, $Z=14$. X-ray powder data (70 lines) are given; the average for the strongest lines are, 4.68 (40)(110), 3.09 (45)(021) 2 $\bar{1}$ 1, 2(12), 2.934 (100)(014, 210), 2.674 (60)(0 $\bar{2}$ 6), 2.621 (30)($\bar{1}$ 14), 2.579 (35)(222), 2.156 (40)(206, 3 $\bar{1}$ 2), 1.410 (35).

The mineral is yellow. ρ 3.68, 3.76 measured; 3.82-3.83 calculated from X-ray data. Optically biaxial, positive, $2V$ 34-40°, the extremes of ns reported are α 1.748, β 1.750, γ 1.768; α 1.756 β 1.758, γ 1.767. In thick grains faintly pleochroic pale yellow to yellow orange, $X' > Z'$.

The mineral occurs as discrete grains in rocks collected by the Apollo XI mission to the Sea of Tranquillity, Moon. The rocks are microgabbros or diabases with major clinopyroxene, plagioclase, and ilmenite, with minor pyroxferroite, cristobalite, tridymite, fayalite, fluorapatite, and K feldspar.

The name is for the composition. The mineral and name were approved before publication by the Commission on New Minerals and Mineral Names, IMA. Type material is preserved at the Lunar Science Institute, Houston, Texas.

DISCUSSION.—It is suggested that the series pyroxferroite-pyroxmangite be divided at $\text{Fe}=\text{Mn}$. Five of the analyses in the literature of "pyroxmangite," including the type material from Iva, S. Carolina, have $\text{Fe} > \text{Mn}$ and are therefore to be renamed as manganoan pyroxferroite. The lunar material is calcian pyroxferroite.

Unnamed Na Nb silicate

E. I. SEMENOV, (1969) *Mineralogy of the Ilimaussaq Alkaline Massif, Southern Greenland*. Inst. Mineral., Geokhim., Kristalloghim. Redk. Elementov, Izdat. "Nauka" 1969, 164 p. [in Russian] (p. 55-60).

Analysis by M. E. Kazakova gave SiO_2 16.46, TiO_2 5.27, Nb_2O_5 50.23, Fe_2O_3 0.48, Al_2O_3 1.38, CaO 5.30, TR_2O_3 0.46, Na_2O 13.71, H_2O 4.64, F 2.50, sum 100.43; $(\text{O}=\text{F}_2)$ 1.05=99.38 percent, corresponding approximately to $(\text{Na}, \text{Ca})_2(\text{Nb}, \text{Ti})_2\text{SiO}_8$ or $(\text{Na}, \text{Ca})_2(\text{Nb}, \text{Ti})_2 \cdot \text{SiO}_7(\text{OH})_2$.

The X-ray pattern (50 lines) by M. Dans gives strongest lines (in Å): 12.364 (18)(020), 7.034 (15)(011), 6.359 (15)(120), 5.464 (18)(031), 3.278 (15)(102, 211), 2.174 (20)(240, 122), 3.149 (20)(042), 2.749 (15)(260), 2.732 (15)(062), 2.604 (12)(202), 1.788 (15)(012, 210). This is indexed by Dans on a unit cell with a 7.411 \pm 0.002, b 24.612 \pm 0.008, c 7.318 \pm 0.003 Å., $V=1340\text{Å}^3$. It was indexed by G. A. Sidorenko (Ito method) as orthorhombic a 11.37, b

6.99, c 6.32A., V 528A³, and by E. B. Khalezova on a tetragonal cell (pyrochlore type) with a 10.37, c 10.59A., V 1135A³.

The mineral occurs as white platy deposits (pseudomorphs after epistolite(?)), up to 5×3×1 cm., associated with neptunite on the north slope of Nakalak Mt. Luster dull. Fracture conchoidal. ρ 3.3 (apparently low). Optically positive, uniaxial or slightly biaxial. Under the microscope, square to long prismatic crystals with two cleavages at right angles. Extinction parallel. n considerably above 1.8. The infra-red absorption spectrum indicates the presence of both molecular water and hydroxyl.

Unnamed "gray minerals"

E. I. SEMENOV, (1969) *Mineralogy of the Ilimaussaq Alkaline Massif, Southern Greenland*. Inst. Mineral., Geokhim., Kristalloghim. Redk. Elementov, Izdat. "Nauka" 1969, 164 p. [in Russian] (p. 106-110).

Analysis by B. A. Solominskaya from Nakalak Mt., Ilimaussaq, gave SiO₂ 46.64, TiO₂ 0.68, Al₂O₃ 20.56, Fe₂O₃ 5.64, FeO 3.59, MnO 0.50, MgO 2.68, CaO 3.28, Na₂O 5.92, K₂O 2.62, H₂O+6.22, H₂O-2.18, sum 100.51 percent. Four similar analyses from Lovozero massif, Kola Peninsula are given; they show small amounts of Zr, Ba, Li, F, Cl, and rare earths. The formula is given as KFeAl₂Si₄O₁₃·3H₂O; the mineral may be a zeolite. The DTA curve shows endothermic breaks at about 100° and 350°. The mineral loses H₂O gradually from 20°C to 500°C; it melts at 1150°C. The infra-red absorption curve indicates some crystallinity.

X-ray data by R. A. Aleksandrova show 40 lines; the strongest (kX): 6.50 (9), 5.85 (6), 4.38 (7), 2.99 (10), 2.84 (8), 2.71 (5), 1.799 (7).

Color light gray to bluish-greenish-gray. Optically isotropic or shows weak aggregate polarization, n about 1.55. Fracture conchoidal.

The mineral is rather widely distributed; occurs in ussingite veins cutting naujaite rock, Nakalak Mt., Greenland, filling cavities in druses of ussingite, natrolite, and analcime, also occurs at several localities in the Lovozero massif, Kola Peninsula, in hydrothermally altered foyaites, juvites and malignites.

"Mn-sepiolite," "Mn-ferrisepiolite"

E. I. SEMENOV (1969) *Mineralogy of the Ilimaussaq Alkaline Massif, Southern Greenland*. Inst. Mineral., Geokhim., Kristalloghim. Redk. Elementov, Izdat. "Nauka" 1969, 164 p. [in Russian] (p. 103-106).

Spectrographic analysis showed high Mn, Fe, Al, Si, Na; also present Ca, Be, Zn, Ti, Sn, Nb. No analysis is given, but the formula is given as Mn₄Fe₄Si₁₂O₃₀(OH)₆·8H₂O in one place, as (Fe, Mn)₉Si₁₂O₃₀(OH)₆·10H₂O in another. The X-ray pattern (S. I. Berkhin) is similar to that of sepiolite. The strongest of the 19 lines are (kX): 12 (10), 4.59 (8), 4.27 (8), 3.75 (7), 3.39 (8), 3.27 (8), 2.68 (8), 2.58 (7), 2.55 (7), 2.45 (7).

Color dark brown. n_s , α 1.72, γ 1.74. Pleochroic, X yellowish, Z red-brown, abs. Z > X. Z = c. Occurs in the analcime zone of foyaitite pegmatite of Nakalak Mt., Ilimaussaq Greenland, in spherulites up to 3 mm diameter of acicular and fibrous crystals. Compare "red Mn-silicate" below.

"Red Mn-silicate"

E. I. SEMENOV (1969), *Mineralogy of the Ilimaussaq Alkaline Massif, Southern Greenland*: Inst. Mineral., Geokhim., Kristalloghim. Redk. Elementov, Izdat. "Nauka" 1969, 1-164 (in Russian), p. 103-106.

Compare "Mn-sepiolite" above.

Analysis by M. E. Kazakova gave SiO₂ 42.45, TiO₂ 0.41, Al₂O₃ 1.85 (Fe₂O₃+FeO) 22.85, MnO 14.61, CaO 1.48, Na₂O 1.44, H₂O⁺ 8.96, H₂O⁻ 5.56, sum 99.61 percent. The

formula is given in one place as $(\text{Mn, Fe})_9\text{Si}_{12}\text{O}_{30}(\text{OH})_6 \cdot 10\text{H}_2\text{O}$, in two places as $\text{Mn}_4\text{Fe}_5 \cdot \text{Si}_{12}\text{O}_{30}(\text{OH})_6 \cdot 8\text{H}_2\text{O}$.

X-ray powder data by S. I. Berkhin gave 26 lines; the strongest are (kX): 13 (10d), 4.59 (5), 2.77 (8), 2.65 (9), 2.44 (7), 2.22 (5b), 1.599 (6b). Single crystal study by V. I. Bukin showed the mineral to be monoclinic, a 33.5 (5.58 \times 6), b 32.2 (3.22 \times 10), c 27.6 Å, β 95°30'.

Color dark red, luster adamantine. ρ 2.36 (low?). Optically negative, 2V small, $\alpha \sim 1.64$. Sections perpendicular to the cleavage are aplochromic with X yellowish, Z reddish-brown, abs. $Z > X$. The infra-red spectrum indicates the presence of both hydroxyl and molecular water.

The mineral occurs with "Mn-sepiolite" in the same foyaite pegmatite of Nakalak Mt., associated with pyrochlore and polyolithionite. It forms isometric to spherulitic accumulations up to 1 cm of platy crystals; individual crystals are up to 3 \times 2 \times 0.5 mm.

Perhaps a polytype of sepiolite.

"Mn-palygorskite," "Mn-ferripalygorskite"

E. I. SEMENOV (1969) *Mineralogy of the Ilimaussaq Alkaline Massif, Southern Greenland*: Inst. Mineral., Geokhim., Kristalloghim. Redk. Elementov, Izdat. "Nauka" 1969, 164 p. [in Russian] (p. 100-102).

Analysis by A. V. Bykova from Karnasurt gave SiO₂ 41.26, TiO₂ 1.21, Al₂O₃ 6.40, Fe₂O₃ 15.00, FeO none, MgO 4.20, MnO 6.58, CaO 1.30, Na₂O 2.70, K₂O 0.80, H₂O⁺ 10.52, H₂O⁻ 10.00, sum 99.97 percent, corresponding to NaMgMnFe₂AlSi₂₀(OH)₂·10H₂O. The DTA curve shows an endothermic break at 50-170°C and an indistinct endothermic break at 400°C. The H₂O is lost gradually to 1000°, mostly below 600°C.

The X-ray pattern (924 lines) by S. I. Berkhin agrees fairly well with that of palygorskite; the strongest lines indexed on the palygorskite cell: (kX) 10.56 (10)(110), 4.44 (4)(040), 3.65 (4)(310), 3.28 (6)(400).

The mineral is rose to red. ρ 2.62. Optically biaxial, neg., 2V large, $Z=c$. n_s (Greenland) α 1.56, γ 1.58; (Lovozero) α 1.545, γ 1.56. Pleochroic, X yellowish, Z red-brown, abs. $Z > X$.

Occur rather commonly in alkalic pegmatites and hydrothermal naujasites at southern Siorarsuit, Ilimaussaq, Greenland, and at Karnasurt Mt., Lovozero, Kola Peninsula, as spherulites of diameter up to 1.5 cm. Associated minerals are natrolite, albite, analcime, spherulite, and neptunite.

Unnamed "white mica"

E. I. SEMENOV (1969) *Mineralogy of the Ilimaussaq Alkaline Massif, Southern Greenland*. Inst. Mineral., Geokhim., Kristalloghim. Redk. Elementov, Izdat. "Nauka" 1969, 164 p. [in Russian] (p. 96-97).

Analysis by T. A. Kapitonova gave SiO₂ 34.12, Al₂O₃ 49.70, Fe₂O₃ 0.49, CaO 0.88, Li₂O 0.50, Na₂O 4.50, K₂O 0.60, H₂O (10.0), total 100.79 percent, corresponding to (Na_{0.88} · Li_{0.17})Al₁(AlSi₃)O₁₀(OH)₂, i.e. the Na-analogue of cookeite.

The strongest X-ray lines (S. I. Berkhin) of 34 given are (in kX): 9.48 (9)(002), 4.41 (6)(020), 3.51 (5)(—), 2.52 (9)(200), 2.41 (8)(008), 2.08 (6)(—), 1.919 (7)(0.0.10), 1.599 (7)(0.0.12), 1.476 (9)(060). From these and an electron diffraction pattern by B. B. Zvyagin, $a = 5.11$, $b = 8.86$, $c \sin \beta = 9.6(\times 2)$.

The mineral occurs in alkalic pegmatite with natrolite and albite in white plates up to 3 \times 2 \times 1 mm in size. Optically negative, nearly uniaxial. The DTA curve shows endothermic breaks at 380° and 900°C; the mineral does not melt at 1200°C. The X-ray pattern indicates that gamma-Al₂O₃ is formed when the mineral is heated.