

NEW MINERAL NAMES*

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Cervelleite*

A.J. Criddle, J.E. Chisholm, C.J. Stanley (1989) Cervelleite, Ag_4TeS , a new mineral from the Bambolla mine, Mexico, and a description of a photo-chemical reaction involving cervelleite, acanthite, and hessite. *Eur. J. Mineral.*, 1, 371–380.

The average of eight electron-microprobe analyses gave Ag 73.0, Cu 0.1, Te 22.2, S 5.3, total 100.6 wt%, leading to a formula $\text{Ag}_{3.99}\text{Cu}_{0.01}\text{Te}_{1.02}\text{S}_{0.97}$, ideally Ag_4TeS . Least-squares refinement of 13 lines from an X-ray powder photograph (114-mm camera, Cu radiation) indexed on a primitive cubic unit cell, space group unknown, gave $a = 14.03(1)$ Å; with $Z = 24$, $D_{\text{calc}} = 8.53(2)$ g/cm³. The strongest X-ray diffraction lines (15 listed) are 6.29(s,012), 5.00(vvs,022), 4.64(m,122,003), 4.24(vs,113), and 3.766(ms,123). In composition, the mineral is the Te analogue of aguilarite and is similar to mineral Z of Akse-
nov et al. (1969), mineral B of Karup-Møller (1976), and the unnamed (Ag,Cu)₄TeS mineral of Gadzheva (1985).

Cervelleite was found in the same polished section as benleonardite (*Am. Mineral.*, 73, p. 439, 1988); the specimen was collected from the waste dumps of the Bambolla mine, Moctezuma, Sonora, Mexico. Cervelleite occurs as thin (30- μm) rims surrounding irregular inclusions of finely granular acanthite in hessite. Other associated minerals are native silver, pyrite, and sphalerite. The paragenesis occurs with dolomite and quartz as thin (1–2 mm) black and crumbly fracture fillings in a highly altered silicified rhyolite vitrophyre.

Cervelleite in a freshly polished section in reflected light is slightly bluish white to slightly greenish white, is isotropic, and has a reflectance lower than that of hessite but higher than that of acanthite; no internal reflection. Reflectance values (WTiC standard) R and $^{\text{im}}R$ are given in 10-nm steps; standard values are (nm, %) 470, 39.8, 23.8; 546, 38.15, 22.15; 590, 37.0, 21.1; 650, 35.6, 19.9. Color values (for CIE illuminant C) are x 0.302, y 0.311, $Y\%$ 37.8, λ_d 482, $P_c\%$ 3.5. No cleavage, irregular fracture, $\text{VHN}_{10} = 26$. The mineral is difficult to identify in polished section because its appearance is rapidly changed by a profound photochemical surface reaction with acanthite and hessite.

The name is for Dr. Bernard Cervelle (1940–) of

the Laboratoire de Minéralogie et Cristallographie, Université Pierre et Marie Curie, Paris, currently chairman of the Commission on Ore Mineralogy (IMA). The type specimen is preserved at the British Museum (Natural History). E.A.J.B.

Edgarbaileyite*

A.C. Roberts, M. Bonardi, R.C. Erd, A.J. Criddle, C.J. Stanley, G. Cressey, R.J. Angel, J.H.G. Laflamme (1990) Edgarbaileyite, the first known silicate of mercury, from California and Texas. *Mineral. Record*, 21, 215–220.

The mineral has been identified in material from the Socrates mine, Sonoma County, California (type locality), the Clear Creek claim, San Benito County, California, and in a museum specimen labeled as from Terlingua, Brewster County, Texas. Electron microprobe analysis of the mineral from Terlingua gave Hg 87.5, Si 3.7, O_{calc} 7.8, sum 99.0 wt%, corresponding to $\text{Hg}_{6.2}\text{Si}_{1.9}\text{O}_{6.9}$, ideally $\text{Hg}_6\text{Si}_2\text{O}_7$; analyses of the mineral from the Socrates mine gave similar results. The infrared spectrum does not show the presence of OH or H₂O. In specimens from the Socrates mine and from the Clear Creek claim, the mineral occurs as thin crusts on fracture surfaces, as disseminated round to mammillary masses in small cavities, and as hollow mammillary modules; it occurs in the Terlingua specimen as cryptocrystalline aggregates and as sheaves of platy crystal aggregates up to 2 × 2 mm, individually up to 200 μm and showing dominant {100}, polysynthetically twinned on {100}. Lemon yellow to orangish yellow when fresh, photosensitively darkening to dark olive green, yellowish green, or dark green-brown. Streak pale green with a yellowish tinge, luster vitreous (crystals) to resinous (masses), translucent (crystals) to opaque (masses), $H = 4$, $\text{VHN}_{100} = 192$ (153–217), $D_{\text{meas}} = 9.4(3)$, $D_{\text{calc}} = 9.11$ g/cm³ with $Z = 2$. Readily soluble in dilute HCl. Optically biaxial, with maximum and minimum calculated refractive indices of 2.58 and 2.10 (590 nm); lemon yellow color and weakly pleochroic in transmitted light. Gray in reflected light, strongly birefractant, non-pleochroic; R_1 and R_2 are given in 10-nm steps in air and oil. X-ray structural study indicated monoclinic symmetry, space group $C2/m$, $a = 11.725(4)$, $b = 7.698(2)$, $c = 5.967(2)$ Å, $\beta = 112.07(3)^\circ$ as refined from a Guinier-de Wolff powder pattern (Co radiation). Strongest lines of the pattern are 6.28(20,110), 3.160(100,021), 2.952(34,202), 2.765(20,002), 2.715(63,400), 2.321(24,421), and 1.872(36,602).

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

Associated minerals in the Terlingua specimen are montroydite, terlinguaite, eglestonite, and native mercury in cavities and fractures in a matrix of calcite, quartz, and barite. Associated minerals in the specimens from California are quartz, native mercury, cinnabar, and montroydite; several new, but as yet undescribed, Hg-bearing minerals are present in material from the Clear Creek locality. The new name is for Dr. Edgar Herbert Bailey (1914–1983), geologist and mercury commodity specialist for the U.S. Geological Survey. Holotype material is in the National Mineral Collection at the Geological Survey of Canada, Ottawa. **J.L.J.**

Ferrokesterite*, Petrukite*

S.A. Kissin, D.R. Owens (1989) The relatives of stannite in the light of new data. *Can. Mineral.*, 27, 673–688.

Ferrokesterite. The most Fe-rich of three electron-microprobe analyses gave Cu 29.5, Fe 8.7, Zn 5.0, Mn 0.1, Cd 0.1, Sn 27.4, S 30.1, sum 100.9 wt%, corresponding to $\text{Cu}_{1.99}(\text{Fe}_{0.67}\text{Zn}_{0.33})_{21.00}\text{Sn}_{0.99}\text{S}_{4.02}$, ideally $\text{Cu}_2\text{FeSnS}_4$ for the end-member, which is the Fe analogue of kesterite. Steel gray, metallic luster, black streak, $H = 4$, $\text{VHN}_{100} = 238$ (228–255), distinct {110} cleavage, {001} parting, $D_{\text{calc}} = 4.490 \text{ g/cm}^3$ with $Z = 2$. In reflected light, medium gray and indistinguishable from kesterite; in oil, faint reflection pleochroism in shades of gray. Weakly anisotropic and birefractant; reflectance values in air for R_o and R_e are 470 23.9, 26.8; 546 26.0, 27.0; 589 26.3, 27.3; 650 26.0, 26.8. X-ray single-crystal study indicated tetragonal symmetry, space group $I\bar{4}$ (by analogy with kesterite); $a = 5.433(36)$, $c = 10.884(89) \text{ \AA}$ as refined from the powder pattern (114.6-mm Gandolfi camera, Co radiation). Strongest lines of the powder pattern are 3.13(100,112), 2.712(30,020,004), 1.919(60,220,024), 1.110(40,244,228), 1.045(30,336,152), and 0.9182(30,156,352), similar to those of the synthetic counterpart. The mineral occurs in greisen-bordered sulfide veins in granite at the Cligga mine, Cornwall, England. Type material is in the National Mineral Collection at the Geological Survey of Canada, Ottawa, and at the British Museum (Natural History), London, England.

Petrukite. The mineral occurs within massive galena and sphalerite as round grains up to 240 μm in diameter at the Herb claim, Cassiar District, British Columbia; as layers about 200 μm wide, with sphalerite, sakuraiite, chalcopyrite, cassiterite, and arsenopyrite in a polished section of material from the Ikuno mine, Hyogo Prefecture, Japan; as grains up to 400 μm in diameter in quartz with associated chalcopyrite at the Fire Tower North ore body, Mount Pleasant, Charlotte County, New Brunswick. The mean and (range) of eight electron microprobe analyses of material from the Herb claim gave Cu 27.4 (27.3–28.0), Ag 0.9 (0.4–1.2), Fe 12.4 (12.0–12.9), Zn 3.6 (3.1–4.5), Cd not detected, Sn 24.8 (24.3–25.3), In 1.3 (0.9–1.9), S 29.9 (29.6–30.3), sum 100.3 wt%, corresponding to $(\text{Cu}_{1.85}\text{Ag}_{0.03}\text{Fe}_{0.95}\text{Zn}_{0.24})_{23.07}(\text{Sn}_{0.89}\text{In}_{0.05})_{20.94}\text{S}_{3.99}$,

ideally $(\text{Cu,Fe,Zn,Ag})_3(\text{Sn,In})\text{S}_4$ where In is thought to be an essential constituent. In reflected light, brown in air and greenish brown in oil, becoming increasingly gray with increased zinc content. Faint greenish brown reflection pleochroism in oil, weak bireflection. Reflectance percentages for R_1 and R_2 in air are 470 27.0, 27.0; 546 27.8, 27.7; 589 27.6, 27.5; 650 27.4, 27.1. $\text{VHN}_{100} = 319$ (296–353); distinct {110}, {100}, and {010} cleavages, {001} parting. X-ray single-crystal study indicated orthorhombic symmetry, space group $Pmn2_1$ (by analogy with the enargite structure); $a = 7.6671(81)$, $b = 6.4399(32)$, $c = 6.2605(61) \text{ \AA}$ (Herb claim) by refinement of the powder pattern (114.6-mm Gandolfi camera, Co radiation); strongest lines are 3.13(100,002), 2.712(40,121), 1.915(60,400), 1.636(50,402), 1.243(50,151), and 1.106(60,315). The new name is for William Petruk (1930–), mineralogist at the Canada Centre for Mineral and Energy Technology (CANMET), Ottawa, Canada, who noted the possible existence of the mineral in his studies of the Mount Pleasant ores. Metatype specimens have been deposited in several institutions, and cotypes in polished sections are in the National Mineral Collection at the Geological Survey of Canada, Ottawa. **J.L.J.**

Hemloite*

D.C. Harris, B.F. Hoskins, I.E. Grey, A.J. Criddle, C.J. Stanley (1989) Hemloite $(\text{As,Sb})_2(\text{Ti,V,Fe,Al})_{12}\text{O}_{23}\text{OH}$: A new mineral from the Hemlo gold deposit, Hemlo, Ontario, and its crystal structure. *Can. Mineral.*, 27, 427–440.

A representative electron-microprobe analysis (one of five listed) gave As_2O_3 12.5, Sb_2O_3 5.8, TiO_2 38.1, V_2O_5 13.4, Fe_2O_3 26.7, Al_2O_3 1.4, sum 97.9 wt%, corresponding to $(\text{As}_{2.98}\text{Sb}_{0.94})_2(\text{Ti}_{11.25}\text{V}_{4.22}\text{Fe}_{7.01}^{2+}\text{Fe}_{6.87}^{3+}\text{As}_{0.65})\text{O}_{46}(\text{OH})_2$. The presence of OH groups is indicated by X-ray crystal-structural study, the valence states of Ti and V are inferred from structural analogy with the related minerals tomichite and derbylite, and $\text{Fe}^{2+}\text{-Fe}^{3+}$ is apportioned according to charge-balance requirements. The mineral occurs as opaque, subhedral to anhedral grains up to $400 \times 600 \mu\text{m}$, black streak, metallic to submetallic luster, $\text{VHN}_{100} = 913(858\text{--}967)$, no cleavage, curved to irregular fracture, $D_{\text{calc}} = 4.613 \text{ g/cm}^3$ with $Z = 2$. In reflected light, not pleochroic or birefractant, very weakly anisotropic from dark gray to dark brown. Reflectance values (SiC standard) are given in 20-nm steps; representative values (nm, R_1 and R_2 in air and in oil, respectively) are 470 17.7, 18.5, 5.91, 6.27; 546 17.1, 17.8, 5.48, 5.82; 589 16.9, 17.5, 5.38, 5.67; 650 16.8, 17.35, 5.31, 5.59; color values (illuminant C) $Y\%$ 17.1, 17.8; λ_d 473, 474; $P_c\%$ 2.6, 3.2. Single-crystal X-ray study indicated triclinic symmetry, space group $P\bar{1}$, $a = 7.552(1)$, $b = 15.842(2)$, $c = 7.158(1) \text{ \AA}$, $\alpha = 78.36(1)$, $\beta = 84.97(1)$, $\gamma = 86.78(2)^\circ$. The X-ray powder pattern was indexed with $a = 7.158$, $b = 7.552$, $c = 16.014$, $\alpha = 89.06$, $\beta = 104.32$, $\gamma = 84.97^\circ$ to show the relationship to tomichite; strongest lines (114.6-mm Debye-Scherrer camera, Cu radiation) are

3.045(70,211,122), 2.924(100,114), 2.799(80,122), 2.722(90,214), 2.665(90,222), 2.498(70,116), 1.774-(60,128,216), 1.579(60B,243,331,325), and 1.508(60,431,425,038). The structure was refined to $R = 5.26\%$.

The mineral occurs in two samples of a drill core from the Page-Williams gold mine at Hemlo, 35 km east of Marathon, Ontario, near the northeastern shore of Lake Superior. Some of the grains contain inclusions of pyrite and molybdenite, and others form rims on rutile, all in a matrix of quartz and barian microcline containing sphalerite, molybdenite, vanadian muscovite, and sparse arsenopyrite. The new name is for the locality. Type material is in the British Museum (Natural History), London, England, and in the part of the National Mineral Collection housed at the Geological Survey of Canada, Ottawa, Canada. J.L.J.

Lehnerite*

A. Mücke (1988) Lehnerite, $\text{Mn}[\text{UO}_2/\text{PO}_4]_2 \cdot 8\text{H}_2\text{O}$, a new mineral from the Hagendorf pegmatite, Oberpfalz. *Aufschluss*, 39, 209–217 (in German, English abstract).

Electron microprobe analysis gave MnO 7.5, FeO 0.2, UO_3 63.0, P_2O_5 15.1, H_2O (by difference) 14.2, sum 100.0 wt%, corresponding to $(\text{Mn}_{0.993}\text{Fe}_{0.026})_{\Sigma 1.019}[(\text{UO}_2)_{1.035}/\text{PO}_4]_2 \cdot 7.414\text{H}_2\text{O}$ on the basis of $\text{P}_2\text{O}_5 = 1.000$; ideally $\text{Mn}[\text{UO}_2/\text{PO}_4]_2 \cdot 8\text{H}_2\text{O}$, the Mn analogue of bassetite. Single-crystal X-ray study indicated monoclinic symmetry, space group $P2_1/n$, $a = 7.04(2)$, $b = 17.16(4)$, $c = 6.95(2)$ Å, $\beta = 90.18^\circ$ as refined from the powder diffraction pattern (Fe radiation), $Z = 2$, $D_{\text{calc}} = 3.717$ for the empirical formula, $D_{\text{meas}} =$ between 3.5 and 3.6 g/cm^3 . The strongest lines (19 listed) of the powder pattern are 8.56 (100,020), 4.96(60,101), 3.50(80B,200,002), 2.48(30,202,161), 2.23(70,301), 2.17(30,330,113), and 1.746(30,163,272,163).

Lehnerite occurs with decomposed zwieselite and strongly corroded rockbridgeite on the 67-m level in the pegmatite of Hagendorf-Süd, Oberpfalz, Germany. In the same paragenesis occur fluellite, carlhintzeite, morinite, and pachnolite. Lehnerite forms thin pseudotetragonal crystals up to 1 mm, platy along (010) with a layered structure perpendicular to [010]; other forms present are {001}, {100}, {101} and $\{\bar{1}01\}$. Color bronze yellow to yellow, streak whitish yellow, luster glassy to nacreous, cleavage perfect {010}, less perfect {101}, $\{\bar{1}01\}$ and {100}, $H = 2-3$, nonfluorescent. Optically, biaxial negative, $\alpha = 1.599(2)$, $\beta = 1.607(2)$, $\gamma = 1.607(2)$ at 589 nm, $2V = 45^\circ$, $X = b$, $Y:a = 8-10^\circ$, $Z:c = 8-19^\circ$, $r > v$ (strong), weakly pleochroic in shades of yellow (Z darker than Y). Toward the borders of the crystals, $2V$ becomes smaller and the extinction more oblique; in the outermost rim of the crystals, the axial plane is perpendicular to that in the center of the crystals; intermediate zones are uniaxial. This phenomenon is probably related to the variable H_2O contents in the crystals.

The name is for Ferdinand Lehner (1868–1943) from Pleystein, one of the first collectors of Hagendorf minerals. Another mineral previously named lehnerite was shown to be ludlamite by Berman (*Am. Mineral.*, 10, 428–429, 1925). Location of the type material is not indicated but apparently is with the author at the University of Göttingen.

Discussion. The author does not mention whether there is a relation to “fritzscheite,” supposedly a manganese uranium phosphate in the torbernite group (*Dana's System*, 7th ed., vol. 2, 984). E.A.J.B.

Magnesioaubertite*

G. Gebhard, O. Medenbach, W. Gebert (1988) Magnesioaubertite, $(\text{Mg,Cu})\text{Al}(\text{SO}_4)_2\text{Cl} \cdot 14\text{H}_2\text{O}$, a new chlorosulfate from Vulcano, Lipari Islands. *Aufschluss*, 39, 97–102 (in German).

Wet-chemical analysis of the water-soluble but not hygroscopic sulfate gave CuO 5.5, MgO 3.38, Al_2O_3 13.91, SO_3 28.25, Cl 7.6, H_2O 44.0, $\text{O} \equiv \text{Cl}$ 1.71, total 100.93 wt%; on the basis of $\text{S} + \text{Cl} = 3.00$, the formula is $(\text{Mg}_{0.44}\text{Cu}_{0.37}\text{Al}_{0.19})_{\Sigma 1.00}\text{Al}_{1.25}\text{S}_{1.87}\text{O}_{8.02}\text{Cl}_{1.13} \cdot 12.92\text{H}_2\text{O}$, ideally $(\text{Mg,Cu})\text{Al}(\text{SO}_4)_2\text{Cl} \cdot 14\text{H}_2\text{O}$. Single-crystal X-ray study proved the isotypic relation with aubertite (*Am. Mineral.*, 65, p. 205, 1980): triclinic symmetry, space group $P\bar{1}$, $a = 6.31(1)$, $b = 13.20(2)$, $c = 6.29(1)$ Å, $\alpha = 91.7(2)$, $\beta = 94.5(1)$, $\gamma = 82.6(1)^\circ$ as refined from the powder diffraction pattern (114-mm camera, Cu radiation), $Z = 1$, $D_{\text{calc}} = 1.78$, $D_{\text{meas}} = 1.80(3)$ g/cm^3 . The strongest lines (46 listed) of the powder pattern are 4.50(100, $\bar{1}\bar{1}1$), 3.97(80, $\bar{1}\bar{2}1,1\bar{1}1$), 5.61(70,011), 4.25(60, $\bar{1}20$), 3.68-(60,121), 6.26(50,001), 4.81(50,120), 3.12(50,002,210,200), and 2.696(50,141).

Magnesioaubertite occurs as polycrystalline aggregates, always enclosed by pickingerite, on a base of alunogen in a cave (Grotta de Faraglione) at Porte de Levante, on the island Vulcano of the Lipari group, north of Sicily, Italy. The aggregates are up to 2 cm and consist of xenomorphic granular single crystals several hundred micrometers in diameter. The mineral is transparent and has a sky blue color resembling that of chalcantite; white streak, glassy luster, good {010} cleavage, $H = 2-3$. Synthetic Cu-free magnesioaubertite is white. Optically biaxial negative, $\alpha = 1.466(1)$ colorless, $\beta = 1.481(1)$ light blue, $\gamma = 1.4875(5)$ light blue, $2V_z = 112^\circ$ (meas.) and 114° (calc.), $r > v$, $n_x \wedge (010) = 17(1)^\circ$. The compatibility index $[1 - K_p/K_c]$ is 0.015, “superior.”

The new name is for the composition and the analogy with aubertite. Associated minerals are metasideronatrium, native sulfur, aluminocopiapite, and metavoltine. Type material is preserved in the collections of the Mineralogical Institute of the Ruhr University at Bochum, Germany.

Discussion. The mineral is also the chlorine analogue of svyazhinite (*Am. Mineral.*, 70, 877, 1985). E.A.J.B.

Voggite*

A.C. Roberts, A.P. Sabina, T.S. Ercit, J.D. Grice, J.T. Szymanski, R.A. Ramik (1990) Voggite, a new hydrated Na-Zr hydroxide-phosphate-carbonate from the Francon quarry, Montreal, Quebec. *Can. Mineral.*, 28, 155–159.

The ideal formula from X-ray crystal-structure analysis is $\text{Na}_2\text{Zr}(\text{PO}_4)(\text{CO}_3)(\text{OH})\cdot 2\text{H}_2\text{O}$, requiring Na_2O 17.95, ZrO_2 35.69, P_2O_5 20.56, CO_2 12.75, H_2O 13.05 wt%. TGA-EGA gave CO_2 12(2), H_2O 15(2) wt%, and electron-microprobe analysis confirmed the presence of major amounts of Na, Zr, and P and the presence of C; rapid loss of H_2O under the electron beam and the small size of the grains prevented quantitative analyses. The mineral occurs as matted nests, millimeters in size, of colorless crystals averaging $1 \times 0.01 \times 0.01$ mm, elongate [010], showing major {100} and $\{\bar{1}01\}$, and minor {001}. White streak, vitreous luster, brittle, poor {010} cleavage, nonfluorescent, $D_{\text{meas}} = 2.70(2)$, $D_{\text{calc}} = 2.704$ g/cm³ for the ideal formula and $Z = 4$. Optically biaxial positive, $\alpha = 1.569(1)$, $\beta = 1.594(1)$, $\gamma = 1.622(1)$, $2V_{\text{meas}} = 81(5)^\circ$, $2V_{\text{calc}} = 88^\circ$, strong dispersion, $r \ll v$, $X = b$, $Z \wedge a = 22^\circ$ in the obtuse β angle. X-ray study indicated the mineral to be monoclinic, space group $I2/m$; $a = 12.251(5)$, $b = 6.557(3)$, $c = 11.755(5)$ Å, $\beta = 116.12(4)^\circ$ as refined from a 114.6-mm Debye-Scherrer powder pattern (Cu radiation) with strongest lines of 10.2(100, $\bar{1}01$), 5.58(80,011,200), 4.06(60, $\bar{3}01$), 3.89(65, $\bar{1}03$), 3.28-(60,020), 3.181(35,310,202), 3.05(35, $\bar{4}02$), 2.546(40, $\bar{4}04$), and 2.039(40,204, $\bar{5}05$, $\bar{6}02$).

The mineral occurs in cavities of centimeter size in an altered, younger amygdaloidal basalt dike adjacent to its contact with a silicocarbonatite sill at the Francon quarry, Montreal, Quebec. Associated cavity minerals are quartz, calcite, and dawsonite. The new name is for Adolph Vogg, a local amateur mineralogist who discovered the mineral. Type material is in the National Mineral Collection at the Geological Survey of Canada, Ottawa. J.L.J.

Vanadium-titanium carbide

J. Jedwab, J. Boulègue (1989) A vanadium-titanium carbide inclusion in graphite from hydrothermal ejecta at 13°N, East Pacific Rise. *Can. Mineral.*, 27, 617–623.

Electron microprobe analysis of a triangular inclusion, about 1×5 μm, in graphite collected in a sediment trap moored near active hydrothermal vents at 13°N, EPR, gave Ti 35.65 and V 46.74 wt%, major C (17.61 wt% calc.), N and S absent, O detected but in insufficient amounts to form a pure oxide or oxyhydroxide. Based on comparisons with synthetic V-C and Ti-C systems, the results are interpreted to represent a cubic (V,Ti)C phase, analogous to khamrabaevite (Ti,V)C. The inclusion may have formed during serpentinization of C-bearing basalt. J.L.J.

Natural magnéli phases, AlTi phases A and B

A.K. Pedersen, J.G. Rønsbo (1987) Oxygen deficient Ti oxides (natural magnéli phases) from mudstone xenoliths with native iron from Disko, central West Greenland. *Contrib. Mineral. Petrol.*, 96, 35–46.

The xenoliths are black, very fine grained, carbonaceous mudstones that occur at Asuk on northern Disko, Greenland, in a strongly reduced andesite breccia with native Fe. The xenoliths, up to $12 \times 10 \times 6$ cm in size, are slightly rounded and contain up to 2.3 vol% organic fragments, mainly vitrinite and inertinite. Pyrometamorphism has affected the xenoliths; tiny droplets of metallic Fe have formed, always surrounded by a rim of troilite(?). Original clastic grains of Fe-Ti oxides have completely reequilibrated to newly crystallized aggregates up to 80 μm in size. The aggregates consist of one or several magnéli phases and of Al-Ti oxide phases.

Magnéli phases. These phases of Ti oxide have a distinct bluish color and are strongly anisotropic in reflected light. They occur as cores of zoned grains and as aggregated prismatic or irregular grains. All types show lamellar twinning, and variable blue colors (blue, grayish blue, light blue) indicate compositional variations. Electron-microprobe analyses (with conditions extensively discussed in an appendix) show a summation well above 100 wt% when Ti is calculated as TiO_2 , with the highest total being 105.1%. These high totals contrast markedly with the totals close to 100% found for AlTi phase A in the same grain aggregate. The high totals are taken as evidence for the presence of considerable amounts of Ti^{3+} in the blue oxides. Recalculation of the analytical totals to 100% through an adjustment of parts of TiO_2 to Ti_2O_3 places the blue oxides within the range of the homologous series $\text{Ti}_n\text{O}_{2n-1}$ ($4 \leq n \leq 9$) called magnéli phases, a series of structurally interrelated triclinic compounds derived from the rutile structure by a crystallographic shear plane parallel to (121). The analyses show compositions which correspond to the range $\text{TiO}_{1.71}$ to $\text{TiO}_{1.83}$, from slightly more reduced than the phase Ti_4O_7 to the phase Ti_6O_{11} , and one analysis corresponds to the phase Ti_9O_{17} .

Several anomalous blue "rutile" minerals have been described from meteorites and from lunar rocks, but the Disko material constitutes the first description of magnéli phases as minerals.

AlTi phases A and B. AlTi phase A has a gray color and optically resembles normal rutile. Phase A occurs as reaction rims on magnéli phases or as discrete grain aggregates where the reaction has gone to completion. Electron microprobe analyses show a considerable compositional zonation and a substantial compositional intergrain variation. Two analyses yielded SiO_2 0.16, 0.09, TiO_2 88.44, 91.17, NbO_2 n.d., 0.08, Al_2O_3 6.27, 4.29, V_2O_5 0.26, 0.70, Cr_2O_3 0.18, n.d., FeO 0.75, 1.46, MnO 0.10, n.d., MgO 3.24, 2.60, total 99.40, 100.39 wt%. Formulas calculated on the basis of 1 cation show a distinct O deficit compared to ideal TiO_2 , with O contents between 1.85 and 1.90. AlTi phase A may structurally be related

to the magnéli phases; formula calculation on this basis fits $Al_{2-x}[Ti_{0.5}^{4+}(Mg,Fe)_{0.5}]_xTi_{2+x}^{4+}O_{2n-1}$, with x varying between 1.3 and 0.9 and n between 6 and 14.

AlTi phase **B** is pale orange and occurs as blebs (1.5–2 μ m) within some grains of magnéli phases. Phase **B** is characterized by a high Al_2O_3 content, about 17 wt%, and has a comparatively high Ti^{3+} content. Based on 7 O atoms, the ideal formula is $AlTi^{3+}Ti_2^{4+}O_7$. The absence of X-ray and TEM data and of known synthetic Al analogues makes further conclusions on the AlTi phases speculative.

The inferred temperature of oxide equilibration is >1160 °C to ?1200 °C, but formation started at <1000 °C; equilibration took place under pressures of <10 bars; inferred f_{O_2} was about 10^{-15} to 10^{-16} at 1200 °C, 4–5 log units below the Fe-W O buffer. **E.A.J.B.**

Unnamed Pb chlorosulfosalts

Y. Moëlo, O. Balitskaya, N. Mozgova, A. Sivtsov (1989) Chlorosulfosalts from the lead-antimony mineralization of Cougnasses (Hautes-Alpes). *Eur. J. Mineral.*, 1, 381–390 (in French, English abstract).

Massive semseyite in Pb-Sb mineralization at Cougnasses (Hautes-Alpes, France) contains, along a slickenside, a cryptocrystalline product of millimeter size generated by crushing. The material shows a flow texture and consists of boulangerite, tetrahedrite, and two chlorosulfosalts (minerals C and C₁), but these minerals cannot be distinguished under the microscope.

Mineral C. Electron microprobe analyses gave on average Pb 46.56, Ag 0.85, Cu 0.09, Sb 30.46, As 0.88, S 19.83, Cl 0.90, total 99.57 wt%, corresponding to $[Pb_{15.7}(Ag_{0.6}Cu_{0.1})Sb_{0.7}]_{\Sigma 17.1}(Sb_{16.7}As_{0.8})_{\Sigma 17.5}S_{43.2}Cl_{1.8}$, ideally $Pb_{17}Sb_{18}S_{43}Cl_2$. The X-ray powder pattern of the mineral (Guinier-de Wolff camera, Co radiation) shows a limited number of diffuse lines (24 listed); the strongest are 4.08(20), 3.85(50), 3.54(100), 2.82(30), and 2.067(100). Electron microdiffraction shows a 4-Å periodicity along **b**, often with a superstructure doubling this periodicity, and two other periodicities of 45 Å and 21 Å. Mineral C is very similar to the synthetic phase V of Bortnikov et al. (1979); both compounds may be structurally related to playfairite through a coupled substitution $Sb^{3+} + S^{2-} \rightarrow Pb^{2+} + Cl^{-}$, a mechanism already proposed for dadsonite.

Mineral C₁. The average of two electron microprobe analyses gave Pb 49.4, Ag 2.2, Cu 0.1, Sb 27.1, As 0.2, S 19.1, Cl 0.9, total 99.0 wt%, leading to a formula (on the basis of 21 anions) $Pb_{8.05}(Ag_{0.68}Cu_{0.05})_{20.73}(Sb_{7.49}As_{0.07})_{27.56}S_{20.13}Cl_{0.87}$, or ideally $Pb_8AgSb_8S_{20}Cl$. No other natural or synthetic sulfosalts chemically resembles this compound.

The minerals were formed by a reaction of earlier sulfosalts with Cl-rich solutions. It would be interesting to know more about the threshold of salinity, as a function of temperature, that is needed to form such chlorosulfosalts adjacent to the more common sulfosalts. **E.A.J.B.**

Wicksite-like phase

R. Ek, P. Nysten (1990) Phosphate mineralogy of the Hålsjöberg and Hökensås kyanite deposits. *Geol. Förh.* Stockholm Förh., 112, 9–18.

At Hålsjöberg, near Torsby, Värmland, Sweden, kyanite-bearing siliceous rock resembling quartzite contains a complex assemblage of phosphates that includes lazulite-scorzalite, trolleite, augelite, gatumbaite, berlinite, burangaite, ferrowyllieite, and a wicksite-like phase. Nine electron-microprobe analyses indicate that the wicksite-like mineral is probably the same as that from South Dakota described by Peacor et al. (*Can. Mineral.*, 23, 247–249, 1985), which may be the Mn analogue of wicksite. Mössbauer spectra of the mineral from Sweden indicate two Fe^{2+} and one Fe^{3+} positions in the mineral, thereby leading to the newly proposed formula $(Ca,Na)_2(Mn,Fe,Mg)_4(Fe,Al)_2(PO_4)_6 \cdot 4H_2O$. **J.L.J.**

Monoclinic polymorph of SiO₂

G. Mieke, H. Graetsch, O.W. Flörke, H. Fuess (1988) The monoclinic crystal structure of the SiO₂-mineral moganite. *Zeits. Krist.*, 182, 183–184 (in German).

A monoclinic microcrystalline silica polymorph from Gran Canaria was described as a new mineral by Flörke et al. (*Neues Jahrb. Mineral. Abh.*, 149, 325–326, 1984), but in contravention of internationally adopted procedures (*Am. Mineral.*, 70, p. 874, 1985). In 1986 an orthorhombic structure was inferred on the basis of electron-diffraction evidence for the existence of a glide plane. However, crystal-chemical considerations, electron diffraction, and Rietveld refinement of neutron and X-ray data show that the symmetry is only monoclinic, with a triclinic supercell having a volume double that of the primitive unit cell. A new setting is proposed in order to show better the analogies with the quartz structure: space group $I12/a1$, $a = 8.770(2)$, $b = 4.879(1)$, $c = 10.720(2)$ Å, $\beta = 90.08(4)^\circ$, $V = 458.7(3)$ Å³. The relation to quartz is $2a + b$, b , $2c$ (a , b , and c of quartz). The structure consists of corner-linked SiO₄ tetrahedra with 6-membered, 8-membered, and 4-membered rings. The three Si–O–Si angles are 147, 146, and 136°; the tetrahedra are only slightly distorted; the average Si–O distance is 1.614 Å.

Discussion. It is not appropriate to persist in using a disapproved name. The authors might consider submitting a new proposal to the Commission on New Minerals and Mineral Names. **E.A.J.B.**

BaAl₂Si₂O₈·4H₂O

U.H. Jakobsen (1990) A hydrated barium silicate in unmetamorphosed sedimentary rocks of central North Greenland. *Mineral. Mag.*, 54, 81–89.

Unmetamorphosed Lower Cambrian to Lower Silurian, black organic-rich cherts in the Navarana Fjord area,

North Greenland, contain hyalophane, barite, and a hydrated barium silicate for which electron-microprobe analysis gave BaO 29.66, Na₂O 0.18, K₂O 0.45, Al₂O₃ 23.49, SiO₂ 29.05, sum 82.83 wt%, corresponding to (Ba_{0.84}K_{0.04}Na_{0.02})_{20.90}Al_{2.00}Si_{2.02}; assuming H₂O to account for the low analytical totals, formula H₂O varies from 3 to 5.5 and averages 4. The ideal formula thus is Ba-Al₂Si₂O₈·4H₂O. The mineral is <100 μm in size and is anhedral platy to fan-shaped with a pronounced cleavage. **J.L.J.**

Sakhaite-like mineral

P.J. Dunn, D.R. Peacor, J.A. Nelen, R.A. Ramik, J. Innes (1990) A sakhaite-like mineral from the Kombat Mine in Namibia. *Mineral. Mag.*, 54, 105–108.

Electron-microprobe, wet-chemical, and TG-EG analyses of the unaltered core a crystal from the Kombat mine, Tsumeb, Namibia, gave CaO 46.4, MgO 11.7, Al₂O₃ 1.3, SiO₂ 6.2, B₂O₃ 15.9, CO₂ 12.6, H₂O 4.8, sum 98.9 wt%, corresponding to Ca_{23.51}Mg_{8.25}(BO₃)₈[(BO₃)_{4.98}-Al_{0.72}Si_{2.93}O_{11.15}](CO₃)_{8.13}·7.57H₂O. The ideal formula is given below in relation to harkerite and sakhaite:

harkerite: Ca₂₄Mg₈(BO₃)₈[AlSi₄(O,OH)₁₆]₂(CO₃)₈(H₂O,Cl)

sakhaite: 2{Ca₂₄Mg₈[(BO₃)₈(BO₃)₈](CO₃)₈(H₂O)}

sakhaite-like mineral:

2{Ca₂₄Mg₈(BO₃)₈{(BO₃)_y[AlSi₄(O,OH)_{<16}]_x}(CO₃)₈·<8H₂O} where $x = 0.73$ and $y = 5.0$.

X-ray single-crystal study of the sakhaite-like mineral indicates that it is cubic and its space group is a subgroup of *Fd3m* (like that of sakhaite, whereas harkerite is trigonal). Aside from the significant substitution of BO₃ groups by aluminosilicate, which is beyond that previously known for sakhaite, the sakhaite-like mineral also contains a high H₂O content that is not released until relatively high temperatures. The Kombat mineral may be new, but naming is deferred because the relations between symmetry and crystal chemistry are complex and incompletely defined for these types of minerals. **J.L.J.**

New Data

Berndtite polytypes*

P. Bayliss (1990) Mineral nomenclature: Berndtite polytypes. *Mineral. Mag.*, 54, 137.

The two naturally occurring polytypes of berndtite (SnS₂), previously referred to as *C6* (the trigonal phase) and *c27* (the hexagonal phase), are renamed berndtite-2*T* and berndtite-4*H*, respectively. **J.L.J.**

Chaidamuite

W.-M. Li, Q.-G. Wang (1990) Determination and refinement of the crystal structure of chaidamuite. *Science in China (Ser. B)*, 33(5), 623–630 (in English).

X-ray crystal-structure study of chaidamuite, ZnFe(SO₄)₂(OH)·4H₂O, from the type locality in China, showed the mineral to be triclinic, space group *P1*, $a = 7.309(2)$, $b = 7.202(2)$, $c = 9.691(3)$ Å, $\alpha = 89.643$, $\beta = 105.89(3)$, $\gamma = 91.11(2)^\circ$, $Z = 2$, $D_{\text{meas}} = 2.722$, $D_{\text{calc}} = 2.724$ g/cm³, $R = 3.2\%$. All dimensions are similar to those reported previously for monoclinic symmetry (*Am. Mineral.*, 73, p. 1493, 1988), on which basis chaidamuite was considered to be isostructural with guildite, CuFe(SO₄)₂(OH)·4H₂O. Chaidamuite is only pseudo-monoclinic, and it is suggested that the structure of guildite should be examined, as it too may be triclinic. **J.L.J.**

Davyne

E. Bonaccorsi, S. Merlino, M. Pasero (1990) Davyne: Its structural relationships with cancrinite and vishnevite. *Neues Jahrb. Mineral. Mon.*, 97–112.

Energy-dispersion and X-ray crystal-structural analyses of davyne indicate that the mineral is hexagonal, space group *P6₃/m*, $a = 12.705(4)$, $c = 5.368(3)$ Å. The empirical formula is (Na_{4.4}K_{1.5}Ca_{0.1})Ca₂(Si_{5.9}Al_{6.1}O₂₄)(SO₄)_{0.6}Cl_{2.8}, ideally Na₄K₂Ca₂Si₆Al₆O₂₄(SO₄)Cl₂. **J.L.J.**

Robinsonite

A. Skowron, I.D. Brown (1990) Refinement of the crystal structure of robinsonite, Pb₄Sb₆S₁₃. *Acta Crystallogr.*, C46, 527–531.

X-ray crystal-structure determination of synthetic robinsonite gave monoclinic symmetry, space group *I2/m*, $a = 23.698(8)$, $b = 3.980(8)$, $c = 24.466(8)$ Å, $\beta = 93.9^\circ$, $Z = 4$, $D_{\text{calc}} = 5.7$ g/cm³, $R_w = 6.4\%$. The cell dimensions and symmetry are new. **J.L.J.**

Volkovskite

J.A. Mandarino, A.L. Rachlin, P.J. Dunn, Y. Le Page, M.E. Back, B.L. Murowchick, R.A. Ramik, R.B. Falls (1990) Redefinition of volkovskite and its description from Sussex, New Brunswick. *Can. Mineral.*, 28, 351–356.

Electron-microprobe, wet-chemical, and TG-EG analyses of almost micaceous, pink to colorless, pseudohexagonal plates, tabular {010}, that occur in Mississippian evaporites of the Windsor Group in southern New Brunswick, Canada, gave K₂O 3.8, CaO 17.5, SrO 0.4, B₂O₃ 60.5, Cl 2.8, H₂O 13.5, O ≡ Cl 0.6, sum 97.9 wt%, corresponding to K_{1.01}(Ca_{3.91}Sr_{0.05})_{23.96}B_{21.77}O_{46.01}H_{18.77}Cl_{0.99}, ideally KCa₄[B₃O₈(OH)₄][B(OH)₃]Cl·4H₂O as shown by X-ray crystal-structure analysis. Transparent, vitreous

luster, white streak, brittle, nonfluorescent, $H = 2\frac{1}{2}$, perfect {010} cleavage, $D_{\text{meas}} = 2.27(3)$, $D_{\text{calc}} = 2.28 \text{ g/cm}^3$ for the analytical and theoretical formulas with $Z = 1$. Optically biaxial positive, $\alpha = 1.523$, $\beta = 1.530$, $\gamma = 1.596$, $2V_{\text{calc}} = 37^\circ$. X-ray single-crystal study indicated triclinic symmetry, space group $P1$, $a = 6.580$, $b = 23.937$, $c = 6.521 \text{ \AA}$, $\alpha = 90.40$, $\beta = 119.09$, $\gamma = 95.67^\circ$, as refined from a powder pattern with strongest lines of 11.89(70B,020), 7.91(90,030), 5.40(70,110), 3.39(60,070), 3.26(100,102), and 2.641(60,090). The chemical formula and unit cell are new. A specimen of the mineral from the New Brunswick locality has been designated as neotype material and is deposited in the Royal Ontario Museum, Toronto, Canada. **J.L.J.**

Discredited Mineral

Isostannite*

S.A. Kissin, D.R. Owens (1989) The relatives of stannite in the light of new data. *Can. Mineral.*, 27, 673–688.

Holotype isostannite from Cligga Head, Cornwall, England, and topotype specimens from Zinnwald, Czechoslovakia, and the Snowflake mine, Revelstoke, British Columbia, were reexamined by optical microscopy, electron-microprobe analyses, and X-ray powder diffraction patterns. The results indicate that isostannite is a member of the kesterite-ferrokesterite solid-solution series. The discreditation was approved by the IMA. **J.L.J.**