NEW MINERAL NAMES*

Pete J. Dunn, Michael Fleischer, Roger G. Burns and Adolf Pabst

Calciotantite*

A. V. Voloshin, Ya. A. Pakhomovskii, and F. M. Tysheva (1982) Calciotantite, $CaTa_4O_{11}$, a new mineral from granitic pegmatites of the Kola Peninsula. Mineralog. Zhurnal, 4, 75–79 (in Russian).

Microprobe analysis gave Ta_2O_5 91.09, Nb_2O_5 2.84, CaO 6.05, Na_2O 0.05, sum 100.03%, corresponding to $(Ca_{0.99}Na_{0.01})(Ta_{0.80}Nb_{0.20})_4O_{11}$ or $CaTa_4O_{11}$.

The X-ray pattern (22 lines)(unfiltered Fe radiation) has strongest lines 3.15(7)(110), 3.02(10)(111), 2.47(6)(113,202), 1.793(7)(300), 1.551(7)(304), 1.508(10)(222). These are very close to the data of Gasperin, Bull. Soc. Franc. Mineral., 86, 115–116 (1963) for synthetic $CaTa_4O_{11}$. The mineral is hexagonal, space group $P6_3$ or $P6_3/m$, $a = 6.23$, $c = 12.22$Å., D calc. 7.46.

Calciotantite occurs as square to rectangular to hexagonal crystals 0.03–0.05 mm as inclusions in microlite or as veinlets 0.1–0.3 mm in microlite. Colorless, transparent, luster adamantine, no cleavage. Hardness 970 kg/sq. mm, 40g load; 1200 kg/ sq.mm, 20 g load. Does not luminesce in UV light, but becomes slightly blue in cathode rays. Anisotropic, reflectances 486 nm, 16.9,16.3; 551 nm, 17.0,16.6; 589 nm, 17.1,16.7; 656 nm, 18.2,18.0%.

The mineral occurs in granitic pegmatites, restricted to a zone of platy albite with relics of spodumene. Associated minerals include scheelite, apatite, and sometimes wodginite.

The name is for the composition. Type material is at the Mineralogical Museums of the Acad. Sci. USSR, Moscow, and its Kola branch, Apatite. **M.F.**

Claraite*

K. Walenta and P. J. Dunn (1982) Claraite, a new carbonate mineral from the Clara Mine, (Central Black Forest). Chemie der Erde, 41, 97–102.

The mean of two chemical analyses yielded CuO 52.5, ZnO 8.0, MnO 1.2, CO_2 11.6, H_2O 27.0 (by difference), sum = 100.0%. The chemical formula, calculated on the basis of 3 cations, is $(Cu_{2.56}Zn_{0.38}Mn_{0.06})(CO_3)_{1.03}(OH)_{3.94} \cdot 3.85H_2O$, or, ideally, $(Cu,Zn)_3CO_3(OH)_4 \cdot 4H_2O$ with Z = 66.

Single crystals were not obtained. Claraite has optical dispersion, $r \gg v$, which suggests it is triclinic. The strongest lines in the X-ray powder diffraction pattern are: 13.47(10)(1120), 7.84(9)(20$\bar{2}$2), 5.17(6)(30$\bar{3}$3,32$\bar{5}$0), 3.65(8b)(42$\bar{6}$3, 43$\bar{7}$1,41$\bar{5}$4, 52$\bar{7}$0), 3.24(5)(41$\bar{5}$5,51$\bar{6}$4,30$\bar{3}$6,52$\bar{7}$3,53$\bar{8}$0,70$\bar{7}$0,44$\bar{8}$1,53$\bar{8}$1,70$\bar{7}$1), 2.96(6)(44$\bar{8}$3,71$\bar{8}$1,20$\bar{2}$7,51$\bar{6}$5,32$\bar{5}$6,53$\bar{8}$3,70$\bar{7}$3). These diffractions are indexed on a hexagonal pseudocell with $a = 26.22$ and $c = 21.56$Å.

Claraite forms blue spherules with a perfect $\{10\bar{1}0\}$ cleavage;

hardness approximately 2; D meas. 3.35, D calc. 3.34. Claraite is optically negative, is weakly biaxial, and has indices of refraction $\varepsilon = 1.645$ and $\omega = 1.751$ (± 0.002). Claraite is associated with malachite, azurite, and olivenite at the Clara Mine in the Black Forest. The name is for the locality. Type material is preserved at the University of Stuttgart and the Smithsonian Institution. This mineral was originally described in 1975 as an unknown (Der Aufschluss, 26, 369–411; Am. Mineral., 62, 175). **P.J.D.**

Cuzticite*. Eztlite*

S. A. Williams (1982) Cuzticite and eztlite, two new tellurium minerals from Moctezuma, Mexico. Mineral. Mag., 46, 257–259.

The new minerals were found together in oxidized ores at the Bambolla mine, Moctezuma, Sonora. Both occur with various iron oxides, emmonsite, schmitterite, and kuranakhite. Analysis of cuzticite by Marjorie Duggan yielded Fe_2O_3 41.1, Mn_2O_3 ~0.4*,$TeO_2 \cdot H_2O$ 13.6, sum 100.2% *no valence determination, corresponding closely to the formula $Fe_2TeO_6 \cdot 3H_2O$. Cuzticite is yellowish, H = 3, D = 3.9, occurring in crusts with a scaly structure. The X-ray powder pattern was indexed on a hexagonal cell, $a = 5.045$, $c = 10.63$Å. Strongest lines of the powder pattern are 3.246 (10)(103), 2.518(7)(110), 4.871(4)(003),2.239(3)(113) and 1.564(3)(213).

Analysis of eztlite gave Fe_2O_3 24.3, PbO 25.5, TeO_2 26.8, TeO_3 8.6, H_2O 12.3, sum 97.5% leading to the formula $Fe_6Pb_2(TeO_3)_3TeO_6(OH)_{10} \cdot 8H_2O$. Etzlite is blood red, as paper-thin sparking crusts, H = 3, D = 4.5. A possible cell found by the Ito method is monoclinic $a = 6.58$, $b = 9.68$, $c = 20.52$Å, $\beta = 90°15'$. Strongest lines of the powder pattern are 3.426(10)(006), 3.289(10)(200), 4.037(9)(104), 3.239(9)(201). Etzlite grains are deep cloudy orange in thin section and are not pleochroic. Estimated indices are $np = 2.14$, $ng = 2.15$ (white light). A good cleavage, probably (001), is always length slow with extinction (to γ) of 3°, consistent with monoclinic (or lower) symmetry.

The names are derived from the Nahua language; cuzticite from *cuztic*, something red, and eztlite from *eztli* meaning blood. Type material is at the British Museum (N.H.) and the University of Arizona. **A.P.**

Jeanbandyite*

A. R. Kampf (1982) Jeanbandyite, a new member of the stottite group from Llallagua, Bolivia. Mineral. Record, 13, 235–239.

Microprobe analysis of six crystals yielded MgO 0.61 (0.24–1.27), SiO_2 0.79 (0.55–0.94), MnO 5.82 (4.04–7.54), Fe_2O_3 22.07 (19.22-24.71), SnO_2 49.61 (48.30–51.59), H_2O 21.10 (18.14–22.44) by difference, sum = 100.00%. Fe was assigned as Fe^{3+} based on microchemical tests. This analysis is calculated on the basis of 6 (OH) as: $(Fe^{3+}_{0.71}Mn^{2+}_{0.21}Mg^{2+}_{0.04})(Sn^{4+}_{0.84}Si_{0.03})(OH)_6$ with excess charge balance assumed to be due to a small portion of the Fe

being present as Fe^{2+}. The idealized formula is $Fe_{1-x}^{3+}Sn_{1-y}^{4+}(OH)_6$ or $(Fe_{1-x}^{3+}\square_x)(Sn_{1-y}^{4+}\square_y)(OH)_6$, with $3x + 4y = 1$.

X-ray study indicated jeanbandyite is tetragonal, $P4_2/n$ (pseudocubic) with $a = c = 7.648$Å, $Z = 4$, D calc. = 3.81, D meas. = 3.81. The strongest lines in the powder pattern (22 given) are: 4.41(20)(111), 3.83(100)(200), 2.71(70)(220), 1.912(20)(400), 1.710(60)(420), 1.562(35)(422).

The mineral occurs as 0.2 mm pseudo-octahedral aggregates of jeanbandyite crystals epitaxially grown on wickmanite. Forms present are {111}, {001}, and {100}. Jeanbandyite is brown-orange; streak pale brown yellow; hardness 3½; cleavage is fair, parallel to {001} and {100}. Optically uniaxial negative, $\varepsilon = 1.833(5)$ and $\omega = 1.837(5)$. Jeanbandyite occurs on museum specimens from level 295 of the Contacto vein. Llallagua, Bolivia and other levels of the mine. Associated minerals include fluorapatite, stannite, pyrite, jamesonite, cassiterite, and crandallite, among others. Jeanbandyite is a member of the stottite group and is related to wickmanite and schoenfliesite.

The name is for Mrs. Jean Bandy of Wickenburg, Arizona, wife of Mark Chance Bandy who collected the material. Type material is preserved at the Smithsonian Institution, Harvard University, and the Los Angeles County Museum of Natural History. **P.J.D.**

Meta-uranocircite II

F. Khosrawan-Sazedj (1982) The crystal structure of meta-uranocircite II, $Ba(UO_2)_2(PO_4)_26H_2O$. Tschermaks Min. Petr. Mitt., 29, 193–204.

X-ray study of 0.6 mm synthetic crystals corresponding to the meta-uranocircite II of Walenta (J. Geol. Landesamt Baden-Wurttemberg, 6, 113–135 (1964) showed it to be monoclinic, $P112_1/a$, with $a = 9.789$, $b = 9.882$, $c = 16.868$Å, $\gamma = 89.95°$, $Z = 4$, for the formula given above. The studied single crystals are yellow, rectangular, biaxial negative, with $2V = 28$–$40°$. Partial chemical analysis yielded Ba = 14.7% (microprobe), $H_2O = 11\%$, compared with the theoretical composition of the hexahydrate which requires Ba 14.08, H_2O 11.07%.

Discussion: Because this phase is monoclinic, it warrants a full description of natural material and IMA consideration of the species and the name. **P.J.D.**

Steacyite*

G. Perrault and J. T. Szymański (1982) Steacyite, a new name, and a re-evaluation of the nomenclature of "ekanite"-group minerals. Can. Mineral., 20, 59–63.

G. Perrault and P. Richard (1973) L'ekanite de Saint-Hilaire, P. Q. Can. Mineral., 11, 913–929.

The mineral described by Perrault and Richard (1973) as ekanite is redefined as steacyite, $Th(Na,Ca)_2(K_{1-z}\square_z)Si_8O_{20}$. Chemical analyses yield: SiO_2 52.18, 57.92; ThO_2 26.74, 28.03; UO_2 2.47,—; Fe_2O_3 0.18,—; PbO—, 0.07; Re_2O_3—, 0.47; CaO 6.00, 4.92; MnO—, 1.64; MgO—, 0.17; Na_2O 3.53, 3.36; K_2O 4.10, 3.42; H_2O 4.40,—; sums 99.60; 100.00%. X-ray study indicated steacyite is tetragonal; space group $P4/mcc$, $a = 7.58(1)$, $c = 14.77(2)$Å. The strongest lines in the X-ray powder pattern are: 5.30(45)(102), 3.38(100)(202), 3.32(55)(104,211), 2.64(41) (204), 2.00(26)(322,314), 1.821(20)(234,411).

Physical description (from Perrault and Richard, 1973) shows that steacyite occurs as dark brown crystals composed of {100} and {001} in a three-dimensional cruciform habit. The hardness is 5; no cleavage observed; D calc. 3.32, D meas. 2.95 (on porous material); radioactive. Steacyite is uniaxial, negative, with $\varepsilon = 1.572$, $\omega = 1.573$. Steacyite occurs with nenadkevichite, analcime, and acmite in pegmatite veins in the nepheline syenite of Mt. St. Hilaire, Quebec, Canada. The name is in honor of Mr. Harold R. Steacy, curator of the National Mineral Collection housed at the Geological Survey of Canada. Type material is deposited at the l'Ecole Polytechnique de Montreal and cotype material at the Geological Survey of Canada. The crystal structure of steacyite was published by Richard and Perrault (Acta Cryst., B28, 1994–1999 (1972)). **P.J.D.**

Sopcheite*

D. A. Orsoev, S. A. Rezhenova, and A. N. Bodanova (1982) Sopcheite, $Ag_4Pd_3Te_4$, a new mineral from copper–nickel ores of the Monchegorsk pluton. Zapiski Vses. Mineral. Obshch., 111, 114–117 (in Russian).

Microprobe analyses of 2 samples gave Ag 32.62, 33.56; Pd 25.26, 23.92; Fe 0.80, 2.13; Cu 0.09,—; Ni 0.03,—; Te 41.32, 42.13; Bi 0.17,—; As none, none; sum 100.29, 101.74%, corresponding to the formulas $(Ag_{3.78}Fe_{0.18}Cu_{0.02}Ni_{0.01})Pd_{2.96}$ $(Te_{4.04}Bi_{0.01})$ and $(Ag_{3.79}Fe_{0.21})(Pd_{2.74})Fe_{0.25})Te_{4.02}$. A mineral of this composition was reported from Sudbury by Cabri and Laflamme, Econ. Geol., 71, no. 7 (1976), but X-ray data were not obtainable on it.

The X-ray powder pattern was indexed by Akira Kato on an orthorhombic cell, with $a = 9.645$, $b = 7.906$, $c = 11.040$Å., $Z = 4$, D calc. 9.948. The strongest lines (17 given) are 3.33 (10, but quartz present) (013), 2.70(5)(023), 2.56(6)(031), 2.30 (5b)(410,132), 1.805(7b)(241,106).

In reflected light gray with brown tint. Anisotropic, with color effects yellowish-red to bluish. Reflectances are given at 16 wave lengths: 460 nm, 40.3; 540, 43.0; 580, 44.4; 660, 47.3%. Internal reflections absent. Hardness, 10 g load, 134–209, av. 170 ± 35 kg/sq. mm.

The mineral forms xenomorphic veins in chalcopyrite of the Sopcha massif, Monchegorsk pluton. The mineral is in grains not exceeding 0.02 mm. It is intergrown with merenskyite and is associated with chalcopyrite and mackinawite.

The name is for the locality. Type material is at the Mineralogical Museum, Kola Branch, Acad. Sci. USSR, Apatite. **M. F.**

Vuorelainenite*

M. A. Zakrzewski, E. A. J. Burke and W. J. Lustenhouwer (1982) Vuorelainenite, a new spinel, and associated minerals from the Sätra (Doverstorp) pyrite deposit, Central Sweden. Can. Mineral., 20, 281–290.

Microprobe analyses of crystals from Outokumpu, Finland, and Sätra, Sweden, respectively, yielded: TiO_2—, 0.6; V_2O_3 63.3, 58.3; Cr_2O_3 4.7, 5.8; Al_2O_3—, 1.4; MnO 22.0, 27.1; FeO 7.6, 5.8; ZnO [2.4], 0.5, sum = 100.0, 99.5 percent. The idealized end member is MnV_2O_4 but many grains (9 analyses given) have substantial Cr_2O_3 (range 4.7–30.6%) in partial solid solution to manganochromite. Vuorelainenite is the vanadium analogue of manganochromite and the manganese analogue of coulsonite.

X-ray study of fragments yielded powder diffraction data which are indexed on a cubic cell with $a = 8.48(5)$Å. The strongest lines are: 2.985(4)(022), 2.559 (10)(113), 2.118(3)(004), 1.633(8) (115,333), 1.502(8)(044). Vuorelainenite occurs as euhedral, 5–80 μm grains which are opaque and have a brownish gray reflectance color. Hardness (VHN) is 900; D calc. = 4.64. Reflectances in air are (nm, %): 470, 15.7; 546, 15.4; 589, 15.6; 650, 16.2.

Vuorelainenite is found at the contacts between pyrrhotite and gangue and also between pyrrhotite, rutile and pyrophanite at the Sätra Mine, in Central Sweden. It was also described previously from Outokumpu, Finland by Long *et al.*, 1963 (Am. Mineral., 48,33–41). A second occurrence of schreyerite is at the Sätra mine and analyses are provided.

Vuorelainenite is named in honor of Yrjo Vuorelainen, former exploration geologist with the Outokumpu Company and discoverer of the Outokumpu material. Type material is preserved (#153A4) at the Free University in Amsterdam. **P.J.D.**

Unnamed Ag–Au–Hg alloy

K. Basu, N. Bortnykov, A. Mookherjee, N. Mosgova and A. I. Tsepin (1981) Rare minerals from Rajpura-Dariba, Rajasthan, India II: Intermetallic compound $Ag_{74.2}Au_{16.4}Hg_{9.4}$ Neues Jahr. Mineral. Monat., 141, 217–223.

Electron microprobe analyses of 10 spots in one crystal yielded Ag 61.51, Au 24.78, Hg 14.47, sum = 100.76%, which yields $Ag_{0.742}Au_{0.164}Hg_{0.094}$. This phase was found at contacts between galena and owyheeite as grains about 200 μm with high reflectivity and polishing hardness greater than galena. Grain size limitations precluded X-ray study. The samples are from Rajpura-Dariba, Rajasthan, India. **P.J.D.**

Unnamed HgNH$_2$NO$_3$

R. C. Rouse, P. J. Dunn and D. R. Peacor (1982) Mercury amidonitrate crystals from Colorado. Mineral. Record, 13, 233–234.

Crystals of mercury amidonitrate, $HgNH_2NO_3$, were identified on the basis of wet chemical analysis which yielded 72 weight percent Hg and the presence of N in two valence states, together with a characteristic X-ray powder diffraction pattern. The strongest lines in the diffraction pattern, which unambiguously identify the compound, are: 2.953(100)(222), 7.24(80)(011), 5.92(80)(111), 3.412(60)(122), 2.741(60)(123), 2.562(60)(004), 2.487(60)(223,014). The crystals were reportedly found in the 600 level of an unnamed mine in Pitkin County, Colorado, where they were associated with silver and a likasite-like mineral. The crystals occur as light yellowish gray euhedra with {111} and {110} as the only forms. There is no apparent cleavage, but some crystals exhibit a radial texture. The density is 5.03 meas. and 5.15 calc.

The crystals may have formed from the decomposition or reaction of mining explosives, in particular cellulose nitrate, $[C_6H_7O_5(NO_3)_3]_n$, used in dynamite, and mercury fulminate, $Hg(CNO)_2$, used in older dynamite caps.

A crystal structure analysis of these crystals by Randall *et al.*, (1982) Journal of Solid State Chemistry, 42, 221–226, confirmed that this compound is cubic, space group $P4_132$ or $P4_332$ with $a = 10.254$Å. The compound was not named because of the likely unnatural occurrence. **P.J.D.**

Unnamed Pb–Ti–Fe–Re-oxide

H. Sarp, J. Bertrand, J. Deferne and B. W. Liebich (1981) A complex rhenium-rich titanium and iron oxide of the crichton-ite-senaite group Neues Jahr. Mineral. Monat., 433–442.

The mean of 4 microprobe analyses employing different standards yielded: TiO$_2$ 58.09, MnO 0.89, FeO 21.95, SrO 4.39, Y$_2$O$_3$ 2.49, ReO$_2$ 2.63, PbO 9.84, sum = 100.28%. This yields the formula, calculated on the basis of 38 oxygens, $(Pb_{0.87}Sr_{0.83}Y_{0.43})_{\Sigma2.13} (Ti_{14.43}Fe_{6.05}Re_{0.23}Mn_{0.23})_{\Sigma20.94}O_{38}$, with Z = 3.

X-ray study indicated this mineral is trigonal, space group $R3$, with $a = 10.44$ and $c = 20.82$Å on a hexagonal cell. It forms hexagonal crystals, flattened on [001], up to 1.0 mm in size, opaque, black, with metallic luster. D meas. = 5.0, calc. = 5.02. Hardness (Vickers) is 1100–1185 VHN. In plane-polarized reflected light, the mineral is cream-white to white; under crossed nichols it is isotropic to weakly anisotropic with brown to blue-gray reflectance colors. Uncalibrated reflectivity values range from 17.5–19.7%.

This species is considered to be a member of the senaite-crichtonite group or in solid solution between these minerals and magnetoplumbite, The substantial difference is in the presence of two large cations; senaite group minerals have only one. **P.J.D.**

ε-MnO$_2$

F. V. Chukhrov, A. N. Gorshkov, A. V. Sivtsov, Yu. P. Dikov and V. V. Berezovskaya (1982) A natural analogue of ε-MnO$_2$. Izvest. Akad. Nauk S.S.S.R., Ser. Geol., 1, 56–65.

The natural analogue of ε-MnO$_2$, manufactured for the battery industry by electrolytic deposition from aqueous Mn(II) salts, has been identified by electron microscopy in the Akhtenskii limonite deposits of the southern Urals. The ε-MnO$_2$ occurs with psilomelane, together with cryptomelane, nsutite, pyrolusite or polymorphs of todorokite, as aggregates of small platey particles dark gray or black in color. Electron microdiffraction patterns yielded the hexagonal unit cell data $a = 2.85$, $c = 4.48$Å; $P6_3/mmc$ ($C6/mmc$). X-ray energy dispersive analyses showed the natural ε-MnO$_2$ to be pure MnO$_2$ (*c.f.* pyrolusite and ramsdellite), while X-ray photo-electron measurements demonstrated the presence of Mn^{4+} only and the absence of H$_2$O and OH$^-$ ions. The electron diffraction pattern of ε-MnO$_2$ more closely resembles that of feroxyhyte (δ-FeOOH) than does the vernadite (the impure δ-MnO$_2$ polymorph) diffraction pattern. It is suggested that vernadite is an extremely disordered variety of natural ε-MnO$_2$. The formation of ε-MnO$_2$ in the Akhtenskii deposit is associated with the supergene alteration of Mn-bearing siderite in the absence of manganese-oxidizing microorganisms, the presence of which favor the formation of vernadite. The authors also report ε-MnO$_2$ occurring with nsutite in the deposits of Urbanus, Eizengans, East Germany and in the Gumeshevskii deposit in the Urals. **R. G. B.**

Unnamed Pb–Mo sulfide

M. A. Zakrezwski, E. A. J. Burke, and W. J. Lustenhouwer (1982) Vuorelainenite, a new spinel, and associated minerals from the Sätra (Doverstorp) pyrite deposit, central Sweden. Can. Mineral., 20, 281–290.

Microprobe analysis of a 3 μm grain in ullmannite yielded S 25.3, Mn 0.1, Fe 3.7, Pb 37.1, Bi 6.3, W 6.2, sum = 94.5%. The

optical properties are similar to those of molybdenite. The data suggest a structure analogous to those of castaingite, $CuS \cdot 2MoS_2$, femolite, $FeS \cdot 5MoS_2$ and several other phases. **P. J. D.**

NEW DATA

Ekanite

J. T. Szymanski, D. R. Owens, A. C. Roberts, H. G. Ansell and G. Y. Chao (1982) A mineralogical study and crystal-structure determination of nonmetamict ekanite, $ThCa_2Si_8O_{20}$. Can. Mineral., 20, 65–75.

Nonmetamict ekanite from the Tombstone Mountains, Yukon Territory, Canada, was studied by X-ray methods and found to be tetragonal, space group $I422$ with $a = 7.483(3)$ and $c = 14.893(6)Å$. The X-ray powder pattern correlates with that of thermally recrystallized type ekanite. The compounds formerly referred to as "ekanite", but with space group $P4/mmc$, are now considered different from ekanite and are discussed in the description of steacyite (Can. Mineral., 20, 59–63.). **P. J. D.**

Galkhaite

T. T. Chen and J. T. Szymanski (1981) The structure and chemistry of galkhaite, a mercury sulfosalt containing Cs and Tl. Can. Mineral., 19, 571–581.

Microprobe analyses of 47 crystals showed the presence of essential Cs and leads to the formula $(Hg,Cu,Zn,Tl,Fe,\square)_6(Cs, Tl,\square)(As,Sb)_4S_{12}$ in which the Cs content varies from 0.33 to 0.98 per 12 S. The formula is verified by a crystal structure determination. Galkhaite is isometric, space group $I\overline{4}3m$ with $a = 10.365(3)Å$. Thallium is present in all analyses and is distributed over two sites. The studied material (21 analyses given) is from the Getchell Mine, Humboldt County, Nevada. The paper discusses other occurrences, analyses, and type material. **P. J. D.**

Killinite

R. Nawaz (1981) Killinite: a re-examination of its status as a mineral species. The Irish Naturalist's Journal, 20, 120–122.

Optical examination of material from the type locality shows it to be biaxial negative, with indices of refraction $\alpha = 1.545$, $\beta = 1.561$, $\gamma = 1.565$; $2V$ low to medium; optic plane parallel to (010); X normal to (001). X-ray study shows killinite to be a 1M dioctahedral mica and the calculation of three analyses (not given) confirms these observations and indicates a close relationship to hydromuscovite-illite. Killinite is stated to be a variety of muscovite.
Discussion: Although the given data do indicate the studied samples are quite similar to hydromuscovite, additional analytical work is needed to establish this relationship firmly and discredit the species formally. **P. J. D.**

Lovdarite

A. P. Khomyakov, E. I. Semenov, A. V. Bikova, A. A. Voronkov, and N. N. Smol'yanikova (1975) New data on lovdarite. Doklady Akad. Nauk SSSR, Earth Science Sections, 221, 154–157 (translated from Doklady Akad. Nauk SSSR, 221, 699–702 (1975)).

Study of lovdarite from the same pegmatite vein as type material, after comparison with type material by X-ray powder methods, indicated that lovdarite is orthorhombic, space group $P2_1$, with $a = 78.88$, b 6.91 and $c = 7.15Å$. A related pseudocell has $a = 39.44$, $b = 6.91$, and $c = 3.58Å$, space group $P2_1am$. The previous abstract is in Am. Mineral., 59, 874. **P. J. D.**

Loveringite
Mohsite discredited = crichtonite

P. R. Kelly, I. H. Campbell, I. E. Grey and B. M. Gatehouse (1979) Additional data on loveringite $(Ca,REE)(Ti,Fe,Cr)_{21}O_{38}$ and mohsite discredited. Can. Mineral., 17, 635–638.

Loveringite
Additional data for this mineral, the structure of which was published previously (Am. Mineral., 63, 28–36) indicates that loveringite occurs as anhedral to acicular crystals up to 100 μm, which are black, opaque, with metallic to submetallic luster. The hardness (Vickers) is 421–464; D calc. 4.42. In reflected light, loveringite is grayish white with reflectances in white light of 17% in air and 5.9% in oil. The strongest lines in the X-ray powder diffraction pattern are: 3.384(87)(022), 3.037(93)(113), 2.129(68)(104), 1.791(71)(215), 1.589(92)(145), 1.433(100)($\overline{3}14$). Crystallographic and compositional data are repeated from the cited structure paper.
Mohsite
Analysis of neotype mohsite shows that it contains Pb and Sr, but negligible Ca, indicating that it is not the Ca-rich member of the crichtonite group, but an intermediate member of the senaite–crichtonite series. **P. J. D.**

Mooreite

R. J. Hill (1979) Crystal data for mooreite. Australian Mineral., 26, 126–128.
R. J. Hill (1980) The structure of mooreite. Acta Cryst., B36, 1304–1311.

Microprobe analysis of mooreite from Sterling Hill, New Jersey, yielded MgO 26.75, ZnO 23.99, MnO 9.76, SO_3 11.60, H_2O 27.90 (by difference), sum = 100.00%. This yields the new chemical formula $Mg_{9.10}Zn_{4.04}Mn_{1.89}(SO_4)_2(OH)_{26} \cdot H_2O$ with Z = 2.

Crystallographic study indicates that mooreite is monoclinic, $P2_1/a$ with $a = 11.147(3)$, $b = 20.350(6)$, $c = 8.202(3)Å$, $\beta = 92.69(4)°$. The crystal structure was refined to $R = 0.060$. **P. J. D.**

Pitticite, Yukonite

P. J. Dunn (1982) New data for pitticite and a second occurrence of yukonite at Sterling Hill, New Jersey. Mineral. Mag., 46, 261–264.

Pitticite
Microprobe analyses of 7 pitticites from various localities indicate that it is a gel-like mineral of widely varying composition with no apparent stoichiometry. Previously reported minor

amounts of Si, Ca, P and Al are constituents of pitticites but are non-essential. Pitticite is retained as a generic name for amorphous, gel-like, ferric iron arsenate minerals of varying chemical composition.

Yukonite

Yukonite is reported from a second occurrence at the Sterling Hill Mine, Ogdensburg, Sussex County, New Jersey, where it occurs as gel-like, waxy aggregates of brownish color and as dark red, remnant pseudomorphs after koettigite–parasymplesite, associated with ogdensburgite. Microprobe analyses (2) yielded: SiO_2 0.6, 2.2; Al_2O_3 0.8, 1.0; Fe_2O_3 28.8, 28.8; MgO 0.4, 0.6; CaO 10.4, 10.4; MnO 2.1, 2.2; ZnO 3.3, 3.8; As_2O_5 32.1, 39.1; SO_3 0.2, 0.2; H_2O (by difference) 19.7, 12.5; sum = 100.0, 100.0 percent. Pitticite has a weak X-ray powder diffraction pattern with strongest lines 5.60(8), 3.25(10), 2.79(8), 2.52(3), 2.33(3), 2.23(3), 1.63(4b). **P. J. D.**

BOOK REVIEWS

CRYSTALLOGRAPHY: AN INTRODUCTION FOR EARTH SCIENCE (AND OTHER SOLID STATE) STUDENTS. By E. J. W. Whittaker, Pergamon Press, Oxford, 1981. xii + 254 pages. $19.95 soft cover.

As noted in the Preface by L. G. Berry, this book is divided into two parts corresponding to a two course sequence offered to undergraduates at the University of Oxford. Part I (Chapters 1–7) deals with the more classical aspects of crystallography whereas Part II (Chapters 8–18) considers the crystallographic applications of diffraction. Each chapter includes a problem set for which answers are provided.

Many basic concepts are developed rapidly, though clearly, in the first four chapters (p. 1–36). Starting with the analogy of stacking bricks to the formation of a euhedral crystal, the concepts of axes, axial ratios, interaxial angles and interfacial angles are introduced. Building on this analogy, the concepts of translational symmetry—repetitive patterns and simple lattices—and the unit cell are developed. Next, symmetry operations (reflection, proper rotation and roto-inversion) and their relationship to crystals and unit cells are explained and combinations of symmetry operations are used to define the seven crystal systems. In Chapter 4 the crystallographic axes are defined and nomenclature for crystal faces (Miller indices) and zone axes are covered.

The remainder of Part I consists of stereographic projection (Chapter 5), an introduction to crystal forms (Chapter 6) and a development of the 32 crystal classes (Chapter 7). This is more or less standard fare; however, the author does note his preference for several specific form names (ditetragonal sphenoid rather than tetragonal scalenohedron, for example). Hermann–Mauguin notation is used exclusively in Part I in preference to the less popular Schoenflies notation which is not mentioned. Part I concludes with a brief appendix which points out the similar properties within each of the three sets of rotoinversion axes : $2n+1$, $2(2n+1)$ and $4n$.

Perhaps the most remarkable aspect of this book is the breadth of topics covered in Part II. Although coverage of each topic is by necessity brief, the author has concisely treated each topic with detail and rigor sufficient to provide a firm foundation from which the student may choose to build. This part opens with a discussion of the properties of X-rays and an introduction to diffraction (Bragg's Law). Chapters on the geometry, applications and indexing procedures involving both powder techniques (Debye-Scherrer, Gandolfi, Guinier) and selected single crystal techniques (rotation, oscillation) are included.

A brief but excellent treatment of X-ray reflection intensities is given in Chapter 10. This includes development of the structure factor (F_{hkl}) and the various correction factors (temperature factor, multiplicity, Lorentz, polarization, *etc.*). Chapter 15 gives an overview of structure determination using rutile as an example. Other topics include electron diffraction (Chapter 16) and crystallographic aspects of twinning, polytypism and crystal defects (Chapter 17).

The development of the 14 Bravais lattices (Chapter 11) and space group concepts including screw axes and glide planes (Chapter 14), are also reserved for Part II. By covering these topics after the student has been exposed to X-ray diffraction, the author is able to stress the application of systematic extinctions to lattice and space group determinations.

In summary, this book is a well organized, concise and clearly written introduction to both ''classical'' and ''modern'' crystallography. It should serve as an excellent text for any two course introductory sequence in crystallography similar to the Oxford University format.

M. W. PHILLIPS
University of Toledo

MINERAL DEPOSITS OF EUROPE, VOLUME 2: SOUTHEAST EUROPE. Edited by F. W. Dunning, W. Mykura and D. Slater. The Mineralogical Society and The Institution of Mining and Metallury, London, 1982. 304 pages, 183 figures, numerous tables. Price to members £35 or US$87.50 (including postage); nonmembers £42 or US$100.

An introductory chapter by W. Petrascheck (12 p., 1 table, 3 figs.) provides a general geological framework and a discussion of the various periods of mineralization. This is followed by national chapters: Hungary, by G. Morvai (42 p., 15 tables, 27 figs.); Romania, by V. Ianovici and M. Borcos (88 p., 1 table, 74 figs.) Yugoslavia, by S. Jancović (60 p., 7 tables, 36 figs.); Albania, by E. Pumo, V. Melo and B. Ostrosi (12 p., 1 table, 9 figs.); Bulgaria, by B. Bogdanov (18 p., 8 figs.); Greece, by G. Marinos (21 p., 13 figs.); Cyprus, by Y. Hadjistavrinou and G. Constantinou (23 p., 5 tables, 15 figs.). A concluding chapter by A. J. G. Notholt, Mineral Production and Developments in Southeastern Europe (11 p.) includes extensive statistical data, by commodity and by country, for 1960, 1970, 1977, 1978, and 1979 (for Albania, Bulgaria, and Romania many of the figures are estimates).

This volume maintains the high standard set by Volume 1 (Northwest Europe) in providing excellent descriptions in English for many mineral deposits for which little or no information has been available in other than the national language. It includes both metallic and non-metallic deposits (fuels are not covered). The volume has a large page size (11 1/2 × 8 inches), enabling the adequate reproduction of maps and diagrams. This book is