

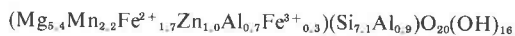
NEW MINERAL NAMES*

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 GEORGE Y. CHAO, AND LOUIS J. CABRI

Baumite*

CLIFFORD FRONDEL AND JUN ITO (1975) Zinc-rich chlorites from Franklin, New Jersey, with a note on chlorite nomenclature. *Neues Jahrb. Mineral. Abh.* **123**, 111-115.

Analysis by J. I. gave SiO₂ 33.5, Al₂O₃ 6.60, Fe₂O₃ 1.65, FeO 9.80, MgO 17.1, ZnO 6.65, CuO 0.03, MnO 12.3, CaO 0.07, Na₂O 0.02, K₂O 0.08, H₂O⁻(140°) 0.2, H₂O⁺(140°) 11.9, sum 99.90 percent, corresponding to the formula



X-ray powder data are given (Fe radiation). The strongest lines of 7 given are 7.23 **10 001**; 3.590 **6 002**; 2.510 **3 201**; hence the mineral is a member of the septechlorite group. When heated at 500° for 1 hour, the mineral gave a weak, diffuse pattern; when heated at 600° gave no pattern.

Color dull black. Found in masses up to a foot in size on the dump of the Buckwheat open pit; it contains angular fragments of willemite and calcite, and is cut by thin veinlets of greenish-black maganoan zincian brunsvigite (analysis and X-ray data given). In thin section baumite is translucent with brownish-yellow color, nearly isotropic, mean *n* 1.598. Under the highest magnification it is seen to be composed of minute birefringent fibers that appear to have parallel extinction.

The name is for John Leach Baum, formerly chief geologist of the New Jersey Zinc Company. M.F.

Biteplatinitite and Biteplapalladite (= Moncheite-Merenskyite Series)

HUANG VAN-KANG, YEH HSIEN-HSIEN, CHANG YUEN-MING, CHUANG TSAN-FU, AND FENG CHUN-MING (1974) Biteplatinitite-merenskyite system and michenerite from a mining district in China and problems concerning their classification and nomenclature. *Geochimica*, **4**, 258-267 (in Chinese with English abstract).

Biteplatinitite

Electron microprobe analysis gave: Pt 39.2, Pd 1.2, Te 58.1, Bi 6.0, sum 104.5 percent, corresponding to (Pt_{0.83}Pd_{0.05})(Te_{1.98}Bi_{0.12}).

White with a strong metallic luster. Mineral grains are irregular to tabular (0.09×0.18-0.11×0.165 mm). Anisotropic, white under reflected light. Reflectance Rg' = 56.1 (green), 57.8 (orange), 58.1% (red). VHN = 120-170 kg/mm², corresponding to 2.5-3.5 on Moh's scale.

Biteplapalladite

Electron microprobe analyses gave (range): Pt 7.0-18.2, Pd 10.9-18.6, Ni 1.1-2.1, Te 50.7-58.8, Bi 12.0-20.0, sum 95.2-

* Minerals marked with an asterisk after the name were approved before publication by the Commission on New Minerals and Mineral Names of the International Mineralogical Association.

102.7 percent, corresponding to (Pd_{0.41-0.71}Pt_{0.14-0.38}Ni_{0.08-0.14})(Te_{1.62-1.80}Bi_{0.20-0.38}).

The mineral is hexagonal with *a* = 4.005(5), *c* = 5.244(8) Å for (Pd_{0.61}Pt_{0.19}Ni_{0.09})(Te_{1.75}Bi_{0.25}) and *a* = 4.036, *c* = 5.259 Å for (Pd_{0.60}Pt_{0.20}Ni_{0.11})(Te_{1.63}Bi_{0.37}). The powder pattern is similar to that of merenskyite with strongest lines (22 given, including β-lines and 3 lines without indices): 5.22 **6 001**, 2.90 **10 101**, 2.09 **6 102**, 2.01 **5 110**, 1.560 **5 103**.

Under the binoculars, the mineral is white to bright white with strong metallic luster. Mineral grains are semi-rounded, prismatic, and hexagonal tabular (0.11×0.11 mm). Under reflected light, the mineral is white with a yellow tint. Anisotropic. Reflectance Rg' = 46.7(400nm) 50.9 (500nm), 56.5 (530nm), 57.7 (590nm), 55.8% (650nm). VHN = 92-205 kg/mm².

Both minerals occur in a Cu-Ni sulfide deposit in fine-grained metagabbro and amphibolite in China (details on locality not given). The metallic minerals in the deposit are mainly pyrite, chalcopyrite, magnetite, and millerite. Other platinum group minerals present are michenerite, moncheite, and merenskyite.

The names are apparently derived from composition, according to the authors' proposed classification scheme based on Pt:Pd ratio: biteplatinitite, >4:1; moncheite, 4:1-1:1; biteplapalladite, 1:1-1:4; and merenskyite, <1:4.

Discussion. Unnecessary names for intermediate members of the moncheite-merenskyite group. It is regrettable that the authors do not follow the generally accepted approach in dealing with a two-end-member solid solution series. GYC, LJC.

Caysichite*

DONALD D. HOGARTH, GEORGE Y. CHAO, A. GEORGE PLANT, AND HAROLD R. STEACY (1974) Caysichite, a new silico-carbonate of yttrium and calcium. *Can. Mineral.* **12**, 293-298.

The mineral occurs in granite pegmatite at the abandoned Evans-Lou feldspar mine, in the province of Quebec. The mine is about 22 miles north of Ottawa. Caysichite lines cavities as a dull white pulverulent coating or as a cream-colored stain. Other, rarer, occurrences are as thin incrustations with a parallel to slightly divergent columnar structure with a reniform surface; as radiating groups and terminated crystals; and as stalactites up to one cm long. Most of the following data apply to colorless crusts. The hardness is 4½ and the VHN is 551. The mineral is non-fluorescent under long or short wave ultra-violet light, but shows a faint green cathodoluminescence under electron bombardment. Caysichite is colorless, white, pale yellow, and rarely greenish. It has a vitreous luster and a white streak. Caysichite effervesces slowly in cold, dilute HCl.

The rare crystals are prismatic, elongated parallel to *c* and terminated by {001}. A prism and dome were observed under high magnification but their Miller indices could not be determined. Caysichite is orthorhombic, *Ccm2*, or *Ccmm*, *a* 13.30, *b* 13.95, *c* 9.74 Å (N.B. If the form identified as a dome is truly a dome, the choice

of space group is narrowed to $Ccm2_1$, **JAM**). The strongest lines in the X-ray powder pattern (in Å for $CuK\alpha$ radiation) are: 6.93 **100** 020, 111; 4.38 **60** 130; 4.22 **60** 310; 3.48 **60** 040; and 3.32 **90** 400.

Caysichite is biaxial (-) with $\alpha = 1.586 \pm 0.004$, $\beta = 1.614 \pm 0.001$, $\gamma = 1.621 \pm 0.001$, $2V$ meas = 53° , $2V$ calc = $54^\circ 30'$, $X = b$, $Y = a$, $Z = c$ for the colorless material. Yellowish crystals are biaxial (-) with $\alpha = 1.589 \pm 0.004$, $\beta = 1.616 \pm 0.001$, $\gamma = 1.626 \pm 0.001$, $2V$ calc = $72^\circ 45' 1''$ (For these indices the calculated $2V$ should be $61^\circ 46'$ **JAM**). In immersion mounts, fragments give nearly centered acute bisectrix figures suggesting {010} cleavage.

Chemical analysis of colorless caysichite (H_2O by a modified Penfield method; CO_2 by both loss on ignition minus H_2O and by titrimetry; all other constituents by electron microprobe) gave: CaO 10.04, Y_2O_3 28.18, RE oxides (details are given in the paper) 8.08, SiO_2 28.84, Al_2O_3 0.58, CO_2 15.7, H_2O 8.6, total 100.02 wt percent. Fourteen other elements ranging from 0.01 to 0.05 wt percent were determined by mass spectroscopy. The chemical analysis yields a formula of $Y_{2.05} Ca_{1.47} RE_{0.35} Si_{3.95} Al_{0.06} O_{10.18} (CO_3)_{2.94} \cdot 3.93 H_2O$. This was calculated on the basis of 19 oxygens (not counting those in the H_2O). If the data are recalculated on the basis of a total of 23 (four from H_2O) oxygens the result is $Y_{2.06} Ca_{1.48} RE_{0.35} Si_{3.96} Al_{0.09} O_{10.24} (CO_3)_{2.94} \cdot 3.94 H_2O$. In either case, the ideal formula is $(Y,Ca,RE)_4(Si,Al)_4O_{10}(CO_3)_3 \cdot 4H_2O$. For $Z = 4$, the calculated density is 3.029 g/cm^3 , which compares favorably with the measured density of 3.03 g/cm^3 .

DTA, TGA, and IR data are given in the paper.

The name is for the composition. Type material is preserved in the National Mineral Collection, Ottawa. **JAM**.

Bazirite

J. R. HAWKES, R. J. MERRIMAN, R. R. HARDING, AND D. P. F. DARBYSHIRE (1975) Rockall Island: new geological, petrological, chemical and Rb-Sr age data. *Inst. Geol. Sci. Gr. Brit. Rep.* 75/1, 11-51.

A preliminary report. Aegirine-riebeckite granite from Rockall Island (between Iceland and the British Isles) was reported by Sabine in 1960 to contain a colorless mineral containing Ba, Zr, and Si. Probe analysis (av. of 19) by Mrs. A. E. Tresham gave SiO_2 40.2, ZrO_2 22.0, BaO 33.7, K_2O 0.3, sum 96.2 percent. The strongest X-ray lines (21 given) are 5.860 **30**, 3.804 **100**, 2.800 **90**, 2.012 **35**, 1.818 **30**, 1.602 **30**; these agree closely with data for artificial $BaZrSi_3O_9$ (card 19-149).

Crystals are small (up to 0.65 mm long, 0.25 mm across), prismatic. Cleavage pyramidal good, prismatic poor. Optically uniaxial, pos., ω 1.673, ϵ 1.685. The mineral is associated with elpidite and quartz. The name is for the composition.

Discussion

The X-ray data indicate this mineral to be isostructural with benitoite and pabstite. **M.F.**

Hafnon*

J. M. CORREIA NEVES, J. E. LOPES NUNES, AND TH. G. SAHAMA (1974) High hafnium members of the zircon-hafnon series from the granite pegmatites of Zambezia, Mozambique. *Contrib. Mineral. Petrol.* 48, 73-80.

Crystals of "zircon" from tantalum-bearing pegmatites of the Conco, Moneia, and Muiane mines, Morrua area, Mozambique,

were found to be hafnium-rich, in fact to have in part $Hf > Zr$. The nomenclature proposed is:

| | |
|------------------|-------------------------|
| Zircon | 0-10 mole % $HfSiO_4$ |
| hafnian Zircon | 10-50 mole % $HfSiO_4$ |
| zirconian Hafnon | 50-90 mole % $HfSiO_4$ |
| Hafnon | 90-100 mole % $HfSiO_4$ |

Probe analyses by Jaakko Siivola on two crystals from Muiane gave SiO_2 28.32, 27.20; HfO_2 69.78, 72.52; ZrO_2 3.28, 1.21, sum 101.38, 100.93 percent, corresponding to ratios $\frac{100 Hf}{(Hf+Zn)} = 92.6$,

97.2, calc 6.32, 6.48. Crystals were zoned, with highest Hf contents at the outer edges. Other samples gave ratios 33-78. Plots of the unit cells show both a and c to decrease nearly linearly and d to increase with increasing ratio. End-members are calculated to have the following parameters.

| | $ZrSiO_4$ | $HfSiO_4$ |
|-------|-------------------|--------------------------------------|
| a_0 | 6.63 ₉ | 6.56 ₇ |
| c_0 | 6.02 ₂ | 5.95 ₁ |
| d | 4.59 | 7.00 (measured d s are much lower) |

Crystals were associated with cookeite and cleavelandite. The name is for the composition.

Discussion

X-ray powder data and optical data would be helpful. **M.F.**

Jagowerrite*

E. P. MEAGHER, M. E. COATES, AND A. E. AHO (1973) Jagowerrite: a new barium phosphate from the Yukon Territory. *Can. Mineral.* 12, 135-136.

Analysis, recalculated after deducting admixed quartz, gave P_2O_5 31.41, Al_2O_3 25.87, Fe_2O_3 0.26, BaO 38.41, H_2O^+ 4.09, S 0.15, sum 100.19 percent, corresponding to the formula $Ba_{1.07} Al_{2.15} Fe_{0.01} P_{1.98} S_{0.02} O_8(OH)_2$, or $BaAl_2(PO_4)_2(OH)_2$. Spectroscopic analysis showed the presence of less than 0.1 percent of Ca, Cr, Ti, V, Ta, Nb, Cu, Be, and Sr. Insol. in HCl.

X-ray study (precession) showed the mineral to be triclinic. The unit cell parameters, refined from X-ray powder data, are a 6.049, b 6.964, c 4.971 Å, α 116.51° , β 86.06° , γ 112.59° , $Z = 1$, G 4.01 meas, 4.05 calc. The strongest X-ray lines (25 given) are 5.55 **40** 100; 3.26 **60** 101; 3.00 **100** 210; 2.94 **55** 110; 2.21 **35** 211; 1.90 **35** 030.

Color light green, luster vitreous, H 4.5. Optically biaxial, positive, n_s (Na) α 1.672, β 1.693, γ 1.710 (all ± 0.003), $2V$ $80 \pm 5^\circ$. Fluoresces greenish-white under long-wave U. V. Cleavages {100} and {011} good, {011} fair.

The mineral is found in crystalline masses up to one inch across in quartz veins in tension fractures in a carbonaceous argillite, 16 miles north of the Hess River, Yukon Territory, Canada. Associated minerals are pyrite and hinsdalite.

The name is for the late J. A. Gower, formerly Professor of Mineralogy, University of British Columbia, where type material is preserved. **M.F.**

Kegelite*

O. MEDENBACH AND K. SCHMETZER (1975) Kegelite, ein neues Beisilicat. *Naturwissenschaften*, 62, 137.

The mineral occurs in very small (30 microns, thickness/micron) pseudo-hexagonal plates that form spherical aggregates, intergrown with hematite and mimetite, in the deep oxidation zone at Tsumeb, S. W. Africa. Other minerals present include leadhillite, anglesite, fleischerite, melanotekite, and alamosite. Microprobe analyses (not given) give the formula $Pb_{12}(Zn,Fe)_2Al_4(Si_{11}S_4)O_{54}$. Insol. in HCl. The strongest X-ray lines are 21.06 **70**, 7.036 **100**, 3.826 **75**, 3.010 **95**, 2.594 **75**. Cleavage not observed.

Optically biaxial, neg., $2V$ very small, n in plane of plates 1.81.

The name is for F. W. Kegel, former director of the mines operations. **M.F.**

Meixnerite*

S. KORITNIG AND P. SÜSSE (1975) Meixnerite, $Mg_6Al_2(OH)_{18} \cdot 4H_2O$, ein neues Magnesium-Aluminium-Hydroxid-Mineral. *Tschermak's Mineral. Petrogr. Mitt.* **22**, 79–87.

Microprobe analysis gave MgO 36.5 (36.21), Al_2O_3 15.0 (15.26), Fe_2O_3 0.55, H_2O (by difference) 47.95 (48.53), sum 100.00 percent, the figures in brackets being the ideal composition corresponding to the formula.

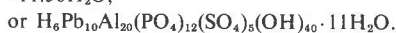
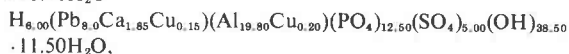
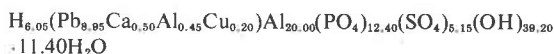
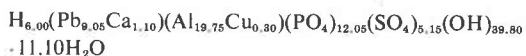
Meixnerite occurs as a secondary mineral with talc and later aragonite in cracks of a serpentine rock near Ybbs-Persenberg, Lower Austria. The crystals are tabular, colorless transparent, optically uniaxial with $\hat{n} = 1.517$, cleavage parallel to 0001 perfect. Meixnerite is trigonal rhombohedral, space group $R\bar{3}m$, a 3.0463 \pm 0.0015, c 22.93 \pm 0.02 Å, $Z = 3/8$; it is structurally related to hydroxalcite.

The new mineral is named in honor of Professor H. Meixner, Salzburg. Type material is preserved in the mineral collections of the Universities of Göttingen and Salzburg. **A.P.**

Orpheite*

B. KOLKOVSKI (1971–72) Orpheite, a new mineral from the Madjarovo deposit, eastern Rhodopes Mountain, Bulgaria. *Ann. Univ. Sofia, Fac. Geol. Geogr.* **64**, 107–130.

Chemical analyses by G. Eskenazi and L. Ivchinova gave P_2O_5 17.09, 17.38, 17.82; As_2O_5 0.07, 0.05, 0.07; SO_3 8.32, 8.12, 7.77; Al_2O_3 20.20, 21.50, 19.45; PbO 40.63, 39.40, 37.71; CaO 1.27, 0.57, 2.02; CuO 0.52, 0.35, 0.41; SiO_2 n.d., 1.14, n.d.; H_2O^- 0.01, –, 0.21; H_2O^+ 12.30 (4.02 to 310°), 12.41 (4.04 to 310°), 11.70; loss on ign. 0.10, –, 2.27, sum 100.51, 100.92, 99.43 percent. Spectrographic analysis shows up to 0.03 percent Zn, and up to 0.01 percent Ba, Cr, Fe, Mg, Mn, and Ti. The mineral is insoluble in acids, dissolves in hot 20 percent KOH solution. The DTA curves show a small endothermic break at about 450°, a large one at about 540°, and a large exothermic break at about 680–720°. Water is lost continuously to about 600° (12.27%); a further loss in weight (10.06%) occurs between 800 and 1000°. The analyses lead to the formulas:



X-ray study shows strongest lines (62 given) 5.66 **100**, 3.50 **67**, 2.967 **100**, 1.901 **33**, 1.749 **26**. These are very close to X-ray data for hinsdalite ($PbAl_3(PO_4)(SO_4)(OH)_6$); they can be indexed on a cell

with a 7.00, c 16.72Å, but this gives $Z = 0.32$ with the formula above.

The mineral is colorless, gray, pale blue, or yellow-green. Luster vitreous. H 3.5, G 3.75 \pm 0.01. Mp about 1200°C. No cleavage or an indistinct one on [0001]. Optically uniaxial, positive, zoned, ω ranges from 1.682 (center) to 1.704 (periphery), ϵ from 1.670 to 1.691, birefringence 0.012–0.013 (note: the data given correspond to uniaxial, neg. M.F.). The colorless varieties do not fluoresce in U.V.; the colored varieties fluoresce in turquoise blue. Infrared spectra are given.

The mineral occurs in the oxidation zone of the Madjarovo polymetallic deposit, associated with hydroxides of Fe and Mn, kaolinite, anglesite, and with pyromorphite which it replaces. The name is for Orpheus, the mythical singer in the Rhodopes. Type material is at the Museum of Mineralogy, "Kliment Ochridski" University, Sofia.

Discussion

Needs further study. The mineral of the beudantite group commonly show departures from the 1:1 ratio of PO_4 (or AsO_4) to SO_3 . I consider this mineral to be probably a variety of hinsdalite. **M.F.**

Pumpellyite and juldite nomenclature*

ELIO PASSAGLIA AND GLAUCO GOTTARDI (1973) Crystal chemistry and nomenclature of pumpellyites and juldites. *Can. Mineral.* **12**, 219–223.

A system of nomenclature is proposed for the pumpellyite series based on the general formula $W_8X_4Y_8Z_{12}O_{86-n}(OH)_n$. In the formula, $W = Ca, K, Na$; $X = Mn, Fe^{2+}, Al$; $Y = Fe^{3+}, Al, Ti$; and $Z = Si$. In apportioning the constituents from an analysis, small amounts of Mn and Fe^{2+} can be shifted to the W position and some Al can be placed in the Z position. Two names are used for all the possible chemical compositions of the series: pumpellyite for those minerals with Al predominant in the Y position and juldite for minerals with Fe^{3+} in the Y position. Further distinctions are made by adding a suffix which denotes the predominant cation in the X position. From eighteen analyses studied by the authors, pumpellyite-(Al) was applied to eleven specimens, pumpellyite-(Fe''') to one, pumpellyite-(Fe'') to one, pumpellyite-(Mg) to four, and juldite-(Fe''') to one. The authors point out two drawbacks of their scheme. First, a mineral rich in Fe''' may receive a name which does not emphasize this aspect of its composition because with Fe''' being distributed in both X and Y sites, it may not be the most abundant cation in either X or in Y . Their pumpellyite-(Fe'') has $Fe''' > Al$ and $Fe''' > Fe''$. They suggest that this mineral could be called "ferrian pumpellyite-(Fe'')". The second drawback which they point out is that is possible to find a pumpellyite-(Al) which contains more Mg than is present in a pumpellyite-(Mg).

Discussion

Although this system of nomenclature was approved by the Commission on New Minerals and Mineral Names, I.M.A., this abstractor feels that it is not a step in the right direction. The system is based on the predominant cations in two positions. That in Y determines the name and that in X determines the suffix. The question of the predominant cations in W and Z never arises. Granted, it may seem unlikely that Al will be greater than Si in the Z position in any subsequent study. Also, looking at the cation amounts in W for the eighteen analyses cited, it is clear that Ca is

much greater than K, Na, Mn, or Fe". However, can we be sure that this will always be the case? I prefer a system of nomenclature to be as flexible as possible so that the unexpected (which occurs more frequently than expected) can be accommodated. I am also opposed to all suffix-type systems of nomenclature with the exception of that proposed by Levinson for rare earth minerals and those proposed for polytype notation. J.A.M.

Ruthenarsenite* and Iridarsenite*

D. C. HARRIS (1974) Ruthenarsenite and iridarsenite, two new minerals from the Territory of Papua and New Guinea and associated irarsite, laurite, and cubic iron-bearing platinum. *Can. Mineral.* **12**, 280-284.

Ruthenarsenite

Examination of more than 75 nuggets or fragments from the Territory of Papua and New Guinea resulted in the discovery of two new minerals, ruthenarsenite and iridarsenite. These new species were found in only two of the nuggets.

Ruthenarsenite occurs as irregular inclusions up to 100 microns long with irarsite and iridarsenite in a matrix of rutheniridosmine. In reflected light (oil immersion) it is pale orange-brown to brownish grey, shows distinct birefractance, and has strong anisotropism varying from orange-brown to light steel-grey. Maximum and minimum reflectance values (averaged for four grains) are: 48.6 and 46.1 (470 nm), 49.5 and 47.5 (546 nm), 50.9 and 49.3 (589 nm), 52.4 and 51.1 (650 nm). Micro-indentation hardness (for two grains) is 743 and 933 kg/mm² for a 100 g load.

Electron microprobe analyses for three grains are given. The average of the determinations from these analyses are: Ir 3.9, Ru 44.2, Os 0.7, Pt —, Rh 3.3, Pd 1.8, Cu —, Ni 4.0, Fe —, As 40.4, S —, total 98.3 wt percent. These data give an average formula of (Ru_{0.81} Ni_{0.12} Rh_{0.08} Ir_{0.04} Pd_{0.03} Os_{0.01}) As_{1.00} or, ideally, RuAs.

Single crystal data could not be obtained, but the X-ray powder pattern could be indexed on the unit cell of synthetic RuAs. Heyding and Calvert (1961) gave the following data for synthetic RuAs: orthorhombic, *Pnma*, *a* 5.70, *b* 3.25, *c* 6.27 Å. A least-squares refinement of the data for ruthenarsenite gave: *a* 5.628, *b* 3.239, *c* 6.184 Å. For *Z* = 4 and a composition of (Ru_{0.88} Ni_{0.11})As, the calculated density is 10.0 g/cm³. The strongest lines in the X-ray powder pattern are (in Å, radiation not given): 2.696 7 102; 2.124 5 210; 2.061 10 112; 1.780 4 301; 1.750 4 212; 1.343 4 114; and 1.302 4 410.

Type material is preserved in the National Mineral Collection, Ottawa. J.A.M.

Iridarsenite

Iridarsenite occurs with ruthenarsenite as inclusions up to 60 microns long with irarsite and ruthenarsenite in rutheniridosmine. In reflected light (oil immersion) it is medium grey with a brownish tint, shows weak to nil birefractance, and has weak but distinct anisotropism varying from medium grey to pale orange-brown. Maximum and minimum reflectance values (averaged for four grains) are: 46.9 and 47.2 (470 nm), 46.1 and 45.4 (546 nm), 46.6 and 44.9 (589 nm), and 44.0 and 41.4 (650 nm). (N.B. for 470 nm, the maximum value given is less than the minimum value. JAM) The micro-indentation hardness (for two grains) is 488 and 606 kg/mm² for a 100 g load.

Electron microprobe analysis for five grains are given. One of these is high in ruthenium. The average of the determinations of the other four are: Ir 52.2, Ru 1.7, Os 0.4, Pt 1.1, Rh 0.2, Pd 0.1, Cu —, Ni —, Fe —, As 44.0, S 0.2, total 99.9 wt percent. The average

formula of the four analyses is given by Harris as: (Ir_{0.88} Ru_{0.08} Os_{0.01} Rh_{0.01} Pt_{0.02} Cu_{0.03}) (As_{1.97} S_{0.03}). [The average formula calculated from the average values above is actually: (Ir_{0.92} Ru_{0.06} Os_{0.01} Pt_{0.02} Rh_{0.01}) (As_{1.98} S_{0.02}) JAM]. The high ruthenium grain gave an analysis of Ir 40.7, Ru 10.3, Os 1.3, Pt 0.5, Rh 0.9, Pd —, Cu —, Ni —, Fe —, As 46.2, S —, total 99.9 wt percent. The formula from these data is (Ir_{0.69} Ru_{0.33} Rh_{0.03} Os_{0.02} Pt_{0.01}) As_{2.00} not (Ir_{0.69} Ru_{0.33} Os_{0.02} Rh_{0.02} Pt_{0.01} Cu_{0.01}) As_{2.00} as given in the paper. The ideal formula of all five grains is IrAs₂.

Single crystal data could not be obtained. The X-ray powder pattern of the mineral is identical to that of synthetic IrAs₂. Quensel and Heyding (1962) state that IrAs₂ is monoclinic with *a* 6.060, *b* 6.071, *c* 6.158 Å, β 113° 16'. Least-squares refinement of the X-ray data for iridarsenite gave: *a* 6.05, *b* 6.06, *c* 6.18 Å, β 113° 17'. For *Z* = 4, the calculated density of IrAs₂ is 10.9 g/cm³. The strongest lines in the X-ray powder pattern are (in Å, radiation not given): 3.90 10 117; 2.84 7 002; 2.61 5 127; 2.069 6 022; and 1.910 5 317.

Type material is preserved in the National Mineral Collection, Ottawa. J.A.M.

Ruthenium*

YUKITOSHI URASHIMA, TADAO WAKABAYASHI, TOSHIYUKI MASAKI, AND YASUNORI TERASAKI (1974) Ruthenium, a new mineral from Horakanai, Hokkaido, Japan. *Mineral. J.* (Tokyo), **7**, 438-444 (in English).

A microprobe analysis of a sample from the Horokanai placer, Hokkaido, gave Ru 64.43, Ir 14.62, Pt 9.14, Rh 7.05, Os 5.29, Pd 0.49, Fe 0.21, Ni, Cu trace, sum 101.23 percent, corresponding to Ru_{0.74} Ir_{0.05} Pt_{0.05} Rh_{0.05} Os_{0.03} Pd_{0.01}.

The mineral is probably hexagonal. It occurs as a tabular crystal 7 × 35 microns, in platy rutheniridosmine. In reflected light white with creamy tint. Reflectivity 60.1 percent at 530 nm. Weakly anisotropic. Type material is at the University of Kagoshima, Japan. M.F.

Sobotkite

CZESLAW HARANCZYK AND KAROL PRCHAZKA (1974) Hydrous magnesium-nickel silicates from Wiry, Lower Silesia. *Prace Muzeum Ziemi*, **22**, 3-64 (in Polish, with English summary, p. 56-62).

Analysis gave SiO₂ 39.68, Al₂O₃ 20.98, Fe₂O₃ trace, MnO trace, MgO 16.72, NiO 0.014, CaO 1.58, K₂O 0.15, Na₂O trace, H₂O ± 20.71, sum 99.83 percent, corresponding to the formula (Ca_{0.13} K_{0.018}) (Mg_{1.91} Al_{0.98}) (Si_{3.06} Al_{0.94}) O₁₀ (OH)₂ · 5.18H₂O, a trioctahedral member of the montmorillonite group. The DTA curve shows endothermic breaks at 180°, 600°, 680° (small), and 830°, and a large exothermic break 890°. The mineral loses about 10 percent H₂O to 300°, 15 percent to 600°, the remainder gradually to 800-900°. The mineral swells with glycerol. The X-ray pattern is diffuse (11 lines) with strongest lines 14.50 7 001; 4.48 9 110,020; 2.61 6 130,200; 2.51 6 202; 2.41 5 007; 2.351 5 203; 1.527 6 060; *b* = 9.16-9.21 Å.

The mineral is pale green, soapy, G (pycnometer) 2.31, H. about 3. Three samples had *ns* 1.523, 1.525, 1.528 (each ± 0.002).

The mineral occurs with nickeloan lizardite, chrysotile, and pimelite in weathered serpentinites of the Gogolow-Jordanow massif, Lower Silesia, Poland. The name is for Mt. Sobotka.

Discussion

It is a difficult problem to decide whether this name should be retained or whether it should be considered to be an aluminian saponite. M.F.

Sudburyite*

LOUIS J. CABRI AND J. H. GILLES LAFLAMME (1974) Sudburyite, a new palladium-antimony mineral from Sudbury, Ontario. *Can. Mineral.* **12**, 275–279.

Sudburyite has been found in polished sections of ore from the Frood mine and the Copper Cliff South mine in the Sudbury area of Ontario. Most of the data are for the Copper Cliff South occurrence. The mineral occurs as small, often elongated, inclusions (18×100 microns or less) in cobaltite and maucherite. Other associated minerals are: chalcopyrite, galena, breithauptite, and nickeline. Pentlandite, pyrrhotite, and michenerite also occurred in the samples.

Electron microprobe analyses are given for ten different grains. These range as follows: Pd 29.2–45.5, Ni 0.48–11.6, Sb 45.3–59.3, Bi 0.53–5.4, Te 0.07–3.9, As 0.03–2.04, total 98.73–102.18. The following analysis (No. 1) is of a grain which gave the highest Pd content: Pd 45.2, Ni 1.06, Sb 52.8, Bi 0.53, Te 0.07, As 2.04, total 101.70. All of the analyses conform to a general formula of (Pd,Ni)(Sb,Bi,As,Te) or, ideally, PdSb. For example, analysis No. 1 (given above) yields the formula $(\text{Pd}_{0.96}\text{Ni}_{0.04})\text{Sb}_{0.98}\text{As}_{0.08}\text{Bi}_{0.01}$.

Under reflected light in air, sudburyite is white with a yellow tint, shows no birefractance, and is weakly to moderately anisotropic. Under oil immersion it is pale yellow, shows no birefractance, and is moderately anisotropic with colors light greyish yellow and dark greyish brown. Reflectance measurements gave: Rp' 53.1–57.1 and Rg' 56.1–60.5 (470 nm), Rp' 54.6–59.9 and Rg' 58.0–63.7 (546 nm), and Rp' 56.2–62.3 and Rg' 60.5–66.7 (589 nm). The value of Rg' is larger for the more Ni-poor compositions. The VHN₂₅ is 281 for one grain and 311 for another.

The mineral is hexagonal with a 4.06 and c 5.59 Å. The strongest lines in the X-ray powder pattern of synthetic PdSb are (in Å for CuK α radiation): 2.98 7 101; 2.18 10 102; 2.03 7 110; 1.202 8 122; 0.9006 7 106.304; 0.8237 9 206.224; and 0.7790 10 107.322. The measured density of synthetic PdSb is 9.37g/cm³. For $Z = 2$, the calculated density is 9.41g/cm³.

A polished section containing sudburyite is preserved in the collections of the Royal Ontario Museum, Toronto. J.A.M.

Taiyite (= Aeschnite-(Y))

CHI LING-YI (1974) Taiyite, a new variety of aeschnite-priorite group. *Acta Geol. Sin.* **1974**, 91–94 (in Chinese with English abstract).

Chemical analysis gave: TiO₂ 45.25, TR₂O₃ 32.41, (Zr,Hf)O₂ 0.26, V₂O₅ 0.03, U₃O₈ 0.61, ThO₂ 0.99, Nb₂O₅ 2.25, Ta₂O₅ 2.25, SiO₂ 5.26, Al₂O₃ 2.32, CaO 0.24, MgO 0.19, MnO 0.08, Fe₂O₃ 1.94, loss on ignition 2.32, sum 99.72 percent, corresponding to (TR_{0.07}U_{0.01}Th_{0.01}Fe_{0.07}Al_{0.13}Sc_{0.01}Mg_{0.01}Ca_{0.01})(Ti_{1.60}Nb_{0.12}Ta_{0.09}Zr_{0.01}Si_{0.24})O_{5.44}(OH)_{0.36}. Distribution of rare earth is Y₂O₃ 49.70, Gd₂O₃ 6.93, Tb₂O₃ 1.74, Dy₂O₃ 14.00, Ho₂O₃ 2.28, Er₂O₃ 6.86, Tm₂O₃ 1.07, Yb₂O₃ 8.39, Lu₂O₃ 1.18, La₂O₃ 0.33, CeO₂ 1.68, Pr₆O₁₁ 0.46, Nd₂O₃ 2.08, Sm₂O₃ 3.19, sum 100 percent. The mineral dissolves in H₂SO₄ + HClO₄, but not in HCl.

Single crystal X-ray work showed the mineral to be orthorhombic, *Pbnm*, with $a = 5.18$, $b = 10.92$, $c = 7.50$ Å. Two sets of unindexed powder data with 34 and 41 lines are given. Strongest lines are: 2.902 10, 2.93 10; 2.715 5, 2.74 6; 2.503 4, 2.56 6; 1.656 4, 1.67 5; 1.580 4, 1.59 6; 1.059 7, 1.062 5B; 1.051 7, 1.055 5B.

The crystals (0.075–0.03 mm) are commonly tabular, and less commonly prismatic; a few crystals are granular. Color pale yellow,

low, orange yellow, and pale greenish yellow. Semi-transparent to translucent. Streak white to pale yellow. Luster pearly on crystal faces and resinous on fracture surfaces. Cleavages {100}, {010}, and {001} perfect. Fracture uneven. Hardness = 4.7, microhardness = 352.5 kg/sq mm. The mineral is brittle and moderately magnetic. Sp. gr. = 4.4.

Optically the mineral is biaxial positive, $\alpha \approx 2.194$, $\beta \approx 2.212$ (calcd), $\gamma \approx 2.248$, $2V \approx 70^\circ$, non-pleochroic with parallel extinction and negative elongation.

The mineral occurs in an yttrium-rare-earth-rich muscovite granite, Southern China, associated with xenotime, monazite, zircon, fergusonite, thorite, doverite, gadolinite, chernovite, columbite, and cassiterite. The mineral is presumably a product of the autometamorphism from biotite granite to muscovite granite.

Discussion

The mineral is simply aeschnite-(Y) (priorite), and no reason for the name is evident. It is apparently a common practice in the People's Republic of China that compositional varieties are named in the same way as mineral species. Sc appears in the calculated formula but not in the chemical analysis. G.Y.C.

Tsavolite

H. BANK (1975) Grüne chrom- und vanadiumhaltige Granate (Grossulare) aus Kenya: Tsavolith-Möglichkeit einer neuen Benennung? *Z. Deut. Gemmol. Ges.* **24**, 13–15.

The name tsavolite (for the Tsavo National Park), near where it was found, is suggested for a bright green to dark green variety of grossular that contains Cr, V, and Mn. It has n 1.74 \pm 0.03, G . 3.68 \pm 0.02.

Discussion. An unnecessary name. M.F.

Unnamed Ag₂CuTeS₂

S. BERGSTÖL AND F. M. VOKES (1974) Stromeyerite and mckinstryite from the Godejord polymetallic sulfide deposit, central Norwegian Caledonides. *Mineral. Dep.* **9**, 325–337.

Stromeyerite and mckinstryite occur intimately associated in irregular patches in the ore. A third phase occurs as small, rounded, apparently exsolved drop-like bodies in the Cu-Ag sulfides. Microprobe analysis showed this phase to be an apparently unknown Cu-Ag-Te-sulfide of formula CuAg₂TeS₂. M.F.

Unnamed (Ba,Sr)VOSi₂O₆

Kazuo Katao Yoshinori Sugitani, and Kozo Nagashima (1974) Absorption spectrum of a new barium vanadyl silicate, BaVOSi₂O₆. *Mineral. J.* (Tokyo), **7**, 421–430.

The spectrum is given; the mineral is stated to be the Ba analogue of haradaite [*Am. Mineral.* **56**, 1123 (1971); **60**, 340 (1975)]. M.F.

Unnamed CaZrSi₂O₇

J. GITTINS, ELVIRA L. GASPARRINI, AND S. G. FLEET (1973) The occurrence of vlasovite in Canada. *Can. Mineral.* **12**, 211–214.

Vlasovite from an agpaitic alkaline rock complex at the Kipawa River, Villedieu Township, Temiskaming County, Quebec (Lat. 46° 47' 49"N, Long. 78° 29' 31"W), contains an alteration product identified as CaZrSi₂O₇. The mineral occurs as radiating sheaves of prismatic crystals 0.1 to 0.3 mm long. Aside from a very low

birefringence, no other optical or physical data could be determined. Electron microprobe analysis (average of two analyses) gave: SiO₂ 40.3, FeO 0.3, MgO 0.1, CaO 18.0, Na₂O 0.4, K₂O 0.1, ZrO₂ 41.3, total 100.5. This gives a formula (based on seven oxygens) of (Ca_{0.98}Na_{0.02}Mg_{0.01}Fe_{0.01}Zr_{1.00}Si_{2.00}O_{7.00}). (This abstractor gets essentially the same results except for Na_{0.04} and K_{0.01}). J.A.M.

Unnamed Pt-Pd Minerals

- P. MIHALIK, J. B. E. JACOBSEN, AND S. A. HIEMSTRA (1974) Platinum-group minerals from a hydrothermal environment. *Econ. Geol.* **69**, 257–262.
- L. J. CABRI AND K. M. PICKWICK (1974) A complex bismuthian palladium telluride intergrowth from the Stillwater Complex, Montana. *Econ. Geol.* **69**, 263–265.

The first paper describes three minerals from the Artonville mine, near Messina, South Africa, occurring with bornite, chalcocite, clausthalite, and digenite. Probe analyses and optical data are given. One mineral appears to be a bismuth-poor kotulskite. Another gave Pt 15.1, Pd 23.4, Te 63.3, Bi 0.1, sum 101.8, corresponding to (Pd_{0.74}Pt_{0.26})Te_{1.67}Bi_{0.001} or (Pd,Pt)₃Te₃. Reflectances (min. and max.) are: 480 nm, 45.8, 47.9; 546 nm, 48.2, 51.3; 589 nm, 48.5, 53.2; 656 nm, 52.3, 56.4 percent. The mineral has a pinkish tinge and is weakly anisotropic.

The second paper describes a very similar mineral that gave a probe analysis Pd 30.79, Ni 0.19, Ru 0.13, Te 51.42, Bi 15.93, sum 98.46 percent, corresponding to Pd₃(Te_{4.18}Bi_{0.79}). Scanning electron microscopy showed however, that the material was an intergrowth of 2 phases, probably merenskyite and kotulskite, with inclusions of hessite. No such intergrowths were found in the material of the first paper.

The first paper also gives data on a third mineral. Probe analyses gave Pt 28.6, 24.2, 18.6; Pd 10.8, 14.8, 15.0; Te 58.3, 60.5, 64.6; Bi none, sum 97.7, 99.5, 98.2, corresponding to (Pt_{0.55}Pd_{0.41})Te_{1.84}, (Pt_{0.47}Pd_{0.53})Te_{1.81}, and (Pt_{0.46}Pd_{0.60})Te_{2.14}, suggesting a series (Pt,Pd)Te₂–(Pd,Pt)Te₂. They may be moncheite-merenskyite. Optical data are given. M.F.

Wroewolfeite*

- P. J. DUNN, R. C. ROUSE, AND J. A. NELEN (1975) Wroewolfeite, a new copper sulphate hydroxide hydrate. *Mineral. Mag.* **40**, 1–5.

Electron microprobe analysis by J. A. N. gave Cu 51.3 ± 0.8, S 6.6 ± 0.2 percent, which calculates to CuO 64.22, SO₃ 16.48, H₂O (by diff.) 19.30 percent, corresponding to Cu₄(SO₄)(OH)₆·2H₂O.

Precession photographs show the mineral to be monoclinic, space group *Pc* or *P2/c*, *a* 6.058, *b* 5.656, *c* 14.360 Å, β 93°28', *Z* = 2, *G*, calc 3.30, observed by flotation 3.27 ± 0.01. The strongest lines of 41 given are 7.152 **100 002**, 3.581 **70 004**, 2.628 **35 022**, 2.004 **30 222, 215**. The X-ray study shows twinning on {001}.

Color deep greenish blue, streak light blue, luster vitreous. Cleavages {010}, {100}, {001}, easy and perfect. *H* 2.5. Optically biaxial, negative, *n*_s α 1.637, β 1.682, γ 1.694, 2*V*–53°, strongly pleochroic, *X* light blue, *Y* deep greenish-blue, *Z* medium greenish-blue, absorption *Y* > *Z* >> *X*.

The mineral occurs in the oxidation zone of the old lead mine at Loudville, Massachusetts, as minute euhedral crystals up to 0.5 × 1.0 mm, associated with chalcocite, covellite, and langite. The mineral alters to brochantite and malachite. It has also been found at two mines in England.

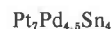
Type material is in the U.S. National Museum, no. 127329. The name is for C. Wroe Wolfe, American Crystallographer. M. F.

Fifteen New Minerals from the Talnakh Deposit

- L. V. RAZIN, V. D. BEGIZOV, AND V. I. MESHCHANKINA (1973) Data on mineralogy of platinum metals in the Talnakh deposit. *Trudy TsNIGRI*, **108**, 96–151, Moscow (English translation in *Int. Geol. Rev.* (1975), **17**, 6–56).

Fifteen minerals are described as “discovered for the first time.” Though no formal names have been presented, a nomenclature is employed, partly in the Tables and partly in the text, that uses the major elements from the quasi-cations and anions. An unfortunate aspect of this approach is that several minor elements, whose presence in any single structure may be non-essential and accidental, are sometimes used in deriving the nomenclature of these minerals. More serious, however, is the complete lack of single crystal data together with proposed non-ideal stoichiometries for all fifteen minerals, the latter being more easily explained by analytical errors. It is also not stated whether or where type material is preserved. (L.J.C.)

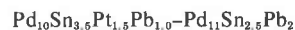
Solid Solution of Pd and Sn in Platinum (=rustenburgite)



Probe analyses gave: Pt 58.3, Pd 19.8, Cu 1.3, Ni 0.9, Fe 0.1, Sn 19.6, Bi 2.5, Pb n.d., total 102.5 percent. Cubic, *Fm3m*, *a* = 3.984(2)Å, *Z* = 4, powder lines: 2.30 **10 111**, 1.997 **7 200**, 1.409 **6 220**, 1.273 **2b 310**, 1.203 **6 311**, 1.150 **4 222**. Reflected light (air?)—bright white with rose tint against chalcocopyrite and silicates, isotropic. Reflectance values in air—460 nm 56.6, 550 nm 59.7, 580 nm 62.2, 640 nm 62.8 percent VHN₂₀ = 304 (301–306) and VHN₅₀ = 384 (367–392). No reaction with any regular etch reagents. Grains average 30–70 microns in diameter and range from 5 to 1080 microns. Occurs as skeletal metacrystals with stepped facets and rectangular cross-sections; as anhedral elongated and isometric grains. Associated minerals: polarite, sperrylite, Au, Au–Ag and Ag–Au alloys, plumbopalladinite, Pd and Pt stannides and arsenides, chalcocopyrite, talnakhite, cubanite, magnetite, valleriite, and silicates.

Discussion. Appears to be identical to rustenburgite (disordered Pt₃Sn) of Mihalik *et al* (1975) *Can. Mineral.* **13**, 146–150; to (Pt,Pd,Ni)₅(Sn,Sb)₂ of Jen and Huang, 1973 (*Am. Mineral.* 1975, **60**, 738), to (Pt,Pd)₅Sn₂ of Razin and Bykov (1971) (*Am. Mineral.* 1972, **57**, 595–596) = unnamed S and with some of the minerals grouped under unnamed Z of Cabri (1972), *Minerals. Sci. Eng.*, **4**, No. 3, 3–29. Unnecessary descriptive name and formula. L.J.C.

Solid Solutions of Pt, Sn, and Pb in Palladium (=atokite)



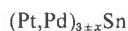
Pd₁₁Sn_{2.5}Pb₂. Probe anal.: Pd 57.0, Pt 4.9, Au 3.3, Sn 14.6, Pb 20.5, Cu n.d., total 100.3 percent. Cubic *Fm3m*, *a* = 3.976(3)Å, 2.29 **10 111**, 1.995 **7b 200**, 1.405 **7b 220**, 1.200 **8b 311**, 1.147 **4b 222**. Reflected light (air?)—pale creamy grey, isotropic, occasionally weakly anisotropic. *R* per cent in air *R*'p 460 nm 55.0, 550 nm 54.6, 580 nm 55.6, 640 nm 59.0. *R*'g 460 nm 55.6, 550 nm 56.6, 580 nm 58.1, 640 nm 61.8. VHN₂₀ = 459(432–598), etches only with aqua regia (strongly). Occurs as rectangular and triangular cross-sections and as anhedral grains with stepped facets. Grains average 60–70 microns in diameter but range from 2 to 700 microns. Associated minerals: chalcocopyrite, cubanite, magnetite, valleriite, polarite, sperrylite, gold-silver alloys and other unnamed PGM.

Pd₁₀Sn_{3.5}Pt_{1.5}Pb_{1.0}. Probe anal.: Pd 50.5, Pt 13.9, Ag 2.9, Au 2.5, Cu 0.1, Sn 21.0, Pb 10.0, total 100.9 percent. Cubic *Fm3m*, *a* =

3.99(1) Å. Reflected light (air?)—greyish white, creamy tinge against Pt-Fe alloys, isotropic. *R* percent in air 460 nm 53.6, 550 nm 60.6, 580 nm 62.3, 640 nm 63.9 VHN₂₀ = 465(423–519). Etches only with aqua regia. Occurs as oval or elongated grains. Grains average 30 microns in diameter but range from 10 to 80 microns. Associated minerals: talnakhite, cubanite, valleriite, Pt-Fe alloys, gold-silver alloys, and other unnamed PGM.

Discussion. Both (a) and (b) appear to be identical to atokitite (disordered Pd₃Sn) of Mihalik *et al* (1975) *Can. Mineral.* **13**, 146–150, to (Pd,Pt)₂(Sn,Pb)₂ of Razin and Bykov (1971) (*Am. Mineral.*, 1972, **57**, 595–596) = unnamed mineral R and with some of the minerals grouped under unnamed Z of Cabri (1972). Unnecessary names and formulae. **L.J.C.**

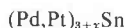
Platinum-Palladium Stannide



Probe analysis gave: Pt 58.6, Pd 16.3, Au 4.6, Cu 1.2, Ni 0.5, Sn 19.2–100.4 percent (Pb n.d.). Cubic *Pm3m*, *a* = 3.984(1) Å and *a* = 3.980 Å. Powder lines: 2.30 **8 111**, 1.994 **6 200**, 1.409 **7 220**, 1.332 **4 221, 300**, 1.200 **6 311**, 1.101 **5 320**, 0.914 **6b 331**, 0.891 **7b 420**, 0.814 **6b 422**. *R* percent in air: 460 nm 53.8, 550 nm 58.9, 580 nm 59.9, 640 nm 62.5. VHN₂₀ = 288(269–321), VHN₅₀ = 274 (245–318), VHN₁₀₀ = 290(272–311). No reaction with standard etch reagents. Grain size, textures, and associated minerals the same as reported for the mineral Pt₇Pd₄Sn₄.

Discussion. This mineral is the ordered form of Pt₃Sn. The name is unfortunate as it implies that Pd is always a requirement. The ± in the formula may be due to analytical errors. **L.J.C.**

Palladium-Platinum Stannide

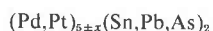


Probe analyses of 3 samples gave Pd 37.6, 41.9, 44.9; Pt 36.2, 27.1, 25.9; Cu 1.6, 1.3, 1.3; Ag 1.7, 1.4, –; Au 1.5, –, 1.5; Ni 0.7, 0.3, 0.4; Rh –, –, 0.5; Sn 22.1, 23.2, 21.8; Pb 0.3, n.d., 3.3; Sb 0.2, –, 0.5; Bi –, –, 0.9; totals 101.9, 95.2, 101.0 percent. Cubic *Pm3m*, *a* = 3.984(2) Å. Strongest powder lines: 2.30 **10 111**, 1.989 **8 200**, 1.407 **8 220**, 1.203 **10* 311**, 1.151 **5 222** plus some weaker reflections indicative of ordering. *R* percent in air for 2 samples: 460 nm 59.2, 57.6; 550 nm 61.2, 61.0; 580 nm 62.2, 61.6; 640 nm 64.0, 62.8. Reflected light (air?)—bright white with creamy tinge if next to chalcopyrite, isotropic. VHN₂₀ = 406(393–419) and 426 (423–432), VHN_{50,100} = 392(387–402). Negative to etching reagents except occasionally with aqua regia. Associated minerals: talnakhite, chalcopyrite, magnetite, polarite, Au-Ag alloys, Pt-Fe alloys, and other unnamed PGM. Occurs as elongated anhedral grains as well as cubic crystals and rectangular grains with stepped facets. Grains average 300–400 microns in diameter but range from 10 microns to 2.2 millimeters.

* This intensity was omitted accidentally.

Discussion. This mineral is the ordered form of Pd₃Sn. The name is unfortunate as it implies that Pt is always a requirement. The ± in the formula may be due to analytical error. **L.J.C.**

Palladium Platinum Arsenoplumbostannide

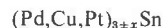


Probe analyses gave: Pd 49.7, Pt 17.0, Ag 1.6, Cu 0.6, Rh 0.5, Sn 17.9, Pb 10.7, As 2.5; total 100.5 percent. Cubic *Pm3m*, *a* = 3.99(1) Å, powder lines 2.31 **10 111**, 2.00 **3 200**, 1.780 **1 210**, 1.617 **1 211**, 1.42 **3b 220**, 1.328 **1 221, 300**, 1.20 **3 311**, 1.15 **1 222**. Reflected light

(air?) white, isotropic, *R* percent in air 460 nm 61.6, 550 nm 66.6, 580 nm 62.6, 640 nm 64.5. Occurs as rectangular, square, or elongated grains and as platy intergrowths with the mineral (Pd,Pt)_{2-x}(As,Sn,Pb). The grains average 50–60 microns in diameter but range from 5 to 90 microns. Associated minerals: chalcopyrite, cubanite, pentlandite, magnetite, valleriite, djerfisherite, sperrylite, polarite, gold, and unnamed PGM.

Discussion. Not enough data to determine whether the formula derived from analysis represents a new species or whether this is a Pb-rich variety of ordered Pd₃Sn. Unnecessary name. **L.J.C.**

Palladium-Copper-Platinum Stannide



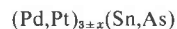
Probe analyses of 5 samples gave: Pd 34.0, 47.7, 49.4, 50.8, 51.1; Pt 27.3, 12.4, 12.4, 13.7, 11.6; Cu 10.4, 8.3, 8.5, 8.6, 11.2; Rh 0.9, 0.7, –, 1.3, –; Au –, 1.1, 0.8, 0.5, –; Sn 25.9, 24.5, 25.0, 22.0, 27.5; Pb 0.4, 1.5, 1.0, 5.7, –; Sb 2.3, 1.1, 1.0, –, –; Bi –, 3.1, –, –, –; Totals = 101.2, 100.4, 99.5, 102.3, 101.4 percent. Tetragonal *P4/mmm*, *a* = 4.072 *c* = 3.720 Å. Strongest powder lines (twelve total) = 2.28 **10 111**, 2.04 **4 200**, and 1.214 **4 311**.

In reflected light (air?) pale creamy grey with rose, brown, or lilac tints. Bireflectance varies from barely perceptible (cream grey) to definite (roseate); weakly to markedly anisotropic with greyish-orange color effects. Usually shows polysynthetic twinning. *R* percent in air for first analysis *R'* 460 nm 41.2, 550 nm 48.0, 580 nm 49.8, 640 nm 53.9; *R'g* 460 nm 44.8, 550 nm 51.6, 580 nm 53.6, 640 nm 57.8. VHN₂₀ = 295(277–344). Weakly etched by aqua regia.

Occurs as oval, isometric, elongated anhedral grains and as margins at intergrowths of Pt minerals; cross sections are rectangular, pentagonal, and triangular. Grains average 40–80 microns in diameter but range from 2 microns to 4 millimeters. Associated minerals: polarite, sperrylite, Au-Ag alloys, Pt-Fe alloys, Ag, other PGM, chalcopyrite, talnakhite, magnetite, valleriite, galena, sphalerite.

Discussion. The mineral is indexed as tetragonal Pd₃Sn with reference to Schubert *et al* (1959). That reference does not discuss Pd₃Sn, however, and Pd₃Sn with tetragonal symmetry is unknown in the Pd-Sn system. Single crystal work is necessary. The ± in the formula may be due to analytical errors. This mineral may be the same as some of the minerals grouped under unnamed Z of Cabri (1972). The name is unfortunate as the essential nature of all the elements is yet to be proved. **L.J.C.**

Palladium-Platinum Arsenostannide



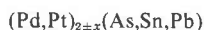
Probe analysis of one grain gave Pd 67.0; Pt 5.2; Au 2.7; Cu 1.0; Sn 16.9; As 7.0; Bi 1.0; Pb not detected; total 100.8 percent. Indexed as tetragonal, *P4/mmm*, *a* = 3.99, *c* = 3.655 Å from a six line powder pattern: 2.23 **10 222**, 1.986 **8 400**, 1.906 **1 401**, 1.471 **3 432**, 1.405 **1 440**, 1.190 **3 622**.

In reflected light (air?) the mineral is light grey with creamy, occasionally yellowish tints; very weakly bireflectant in air; anisotropic with brownish grey colors. *R* percent in air 460 nm 50.6, 550 nm 54.3, 580 nm 55.5, 640 nm 57.5, VHN₂₀ = 480(476–506).

Occurs as anhedral grains, platy intergrowths with (Pd,Pt)_{8-x}(Sn,Pb,As)₂. Grains average 20 microns in diameter but range from 2 to 300 microns. Associated minerals: polarite, sperrylite, Au-Ag alloys, Au, other PGM, chalcopyrite, cubanite, talnakhite, pentlandite, magnetite, valleriite, djerfisherite, galena, and sphalerite.

Discussion. Not enough data to determine whether the mineral is a unique species. The name is unjustified and single crystal work is necessary. **L.J.C.**

Palladium-platinum Plumbostannoarsenide

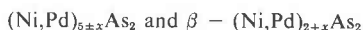


Probe analysis of one grain gave Pd 60.9, Pt 5.4, Ag 2.1, Rh 0.5, Sn 13.0, As 8.8, Pb 6.0, Sb 1.6; total 98.3 percent, Cu, Au not detected. Indexed as tetragonal, $a = 3.99$, $c = 3.655 \text{ \AA}$ from an eleven line powder pattern, strongest lines 2.23 **10 222**, 1.992 **5 400**, 1.476 **4 432**.

Color in reflected light, birefractance, and anisotropy same as for $(\text{Pd,Pt})_{3\pm x}(\text{Sn,As})$ mineral. Also grain size, textures, and associated minerals. R percent in air 460 nm 56.8, 550 nm 56.4, 580 nm 57.4, 640 nm 59.9. $\text{VHN}_{20} = 423(396-449)$, $\text{VHN}_{50} = 515(504-519)$.

Discussion. Appears to be the same mineral as $(\text{Pd,Pt})_{3\pm x}(\text{Sn,As})$, which itself is not well enough characterized to determine if it is a unique species. The name is unjustified. **L.J.C.**

Nickel-Palladium Arsenides



(a) $(\text{Ni,Pd})_{5\pm x}\text{As}_2$. Probe analyses gave Pd 44.0, 45.9, Ni 29.0, 27.5; Cu 0.2, -; Pt -, 0.4; As 28.2, 26.6; totals 101.4, 100.4 percent. Indexed as hexagonal (second analysis) with $a = 9.910$, $c = 6.601 \text{ \AA}$ from ten powder lines of which the strongest are 2.19 **10 0003**, 1.989 **10 2242**, 2.65 **8 2022,3031**, and 2.29 **6 2241,1232**.

In reflected light (air?) the mineral is pale lilac grey with brownish or roseate tinge. Weakly birefractant in air, weakly anisotropic with brownish-grey tones. R percent in air 460 nm 48.6, 550 nm 50.3, 580 nm 51.3, 640 nm 53.7. $\text{VHN}_{20} = 463(440-484)$ and $\text{VHN}_{50} = 527(482-597)$ for first and second analysis, respectively. Occasional etching with 1 : 1 HCl, negative to other reagents.

Occurs as isometric and elongated, lensoid, polygonal crystalline grains, twins, which range from one to 100 microns in diameter and average 10-20 microns. Associated minerals: polarite, Ag-Au alloys, sperrylite, other PGM, chalcopyrite, talnakhite, cubanite, magnetite, silicates, sperrylite, and galena.

(b) $\beta - (\text{Ni,Pd})_{2+x}\text{As}_2$. Probe analysis of one grain gave Ni 56.5; Pd 12.3; As 34.1; total 102.8 percent.

The color under reflected light, birefractance, anisotropism, grain size, textures and mineral associations the same as for the $(\text{Ni,Pd})_{5\pm x}\text{As}_2$ mineral.

Discussion. Not enough data to differentiate between (a) and (b). The powder pattern of (a) is very similar to synthetic Ni_5As_2 of Heyding and Calvert (A.S.T.M. 10-271) which was indexed as hexagonal $a = 6.70$, $c = 12.41 \text{ \AA}$. Single crystal data required. **L.J.C.**

Palladium Bismuthide



Probe analysis of one grain gave Pd 31.6; Pb 1.6; Ag 1.5; Au 0.5; Cu 0.3; Bi 61.1; Te 0.6; total 97.2 percent. Indexed as hexagonal from eleven powder lines, $a = 4.20$, $c = 5.64 \text{ \AA}$, strongest lines 3.05 **10 1011**, 2.24 **8 1012**, 2.097 **8 1120**, 1.178 **5 3031,1124**.

In reflected light (air?) the mineral is pale yellowish cream with noticeable birefractance, weakly to distinctly anisotropic with yellowish-grey tones. R percent in air 460 nm 47.9, 550 nm 57.0, 580 nm 59.2, 640 nm 63.0. $\text{VHN}_{20} = 281(272-286)$.

Occurs as elongated, oval euhedral grains and as fringes which

surround intergrowths of PGM. The grains average 15-20 microns in diameter and range in size from 5 to 100 microns. Associated minerals: polarite, Ag-Au alloys, sperrylite, $(\text{Pd,Cu,Pt})_{3\pm x}\text{Sn}$, electrum, chalcopyrite, cubanite, silicates, galena.

Discussion. Needs further study, especially single crystal work and synthesis. The name has already been used for $\text{PdBi}_{2.6-3.4}$, an incompletely characterized mineral of Shernayev and Yushko-Zakharova (see unnamed mineral 0 of Cabri, 1972). **L.J.C.**

Palladium Stibioarsenide



Probe analysis of one grain gave Pd 78.2; As 12.3; Sn 6.8; Sb 6.3; total 103.6 percent, Pt, Pb not detected. Indexed as orthorhombic $a = 8.107$, $b = 5.625$, $c = 4.360 \text{ \AA}$ from a 10 line powder pattern with strongest lines 2.30 **10 121**, 2.18 **10 002**, 1.126 **4 133**, 1.621 **3 420**.

In reflected light (air?) the mineral is brownish grey, weakly anisotropic, isotropic in certain sections. R percent in air 460 nm 41.2, 550 nm 49.4, 580 nm 51.4, 640 nm 54.5. $\text{VHN}_{20} = 423(396-449)$, $\text{VHN}_{50} = 515(503-519)$.

Occurs as rounded, elongated grains and as hexagonal euhedral crystals ranging from 5 to 50 microns in diameter with an average size of 15 microns. Associated minerals: polarite, Ag-Au alloys, sperrylite, electrum, other PGM, chalcopyrite, talnakhite, silicates, sphalerite, and galena.

Discussion. Single crystal work is required to confirm orthorhombic symmetry because powder pattern is very similar to that of palladoarsenide, Pd_2As (*Am. Mineral.*, **60**, 162). The name is unjustified. **L.J.C.**

Palladium Stannide



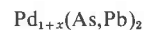
Probe analysis of one grain gave Pd 60.6; Sn 35.5; total 96.4 percent; Pt, Cu, Pb not detected. Orthorhombic, $a = 8.11$, $b = 5.65$, $c = 4.32 \text{ \AA}$ and strongest powder lines for the analyzed grain 2.30 **10 121**, 2.17 **8 002**, 1.278 **6 303**, 2.39 **5 021**. Another grain gave a better powder pattern with $a = 8.104$, $b = 5.643$, $c = 4.312 \text{ \AA}$.

In reflected light (air?) the mineral is light grey with a roseate to creamy birefractance. Strongly anisotropic light grey, bluish to reddish tinge. Polysynthetically twinned. R 'p and R 'g percent in air 460 nm 42.2, 47.4; 550 nm 46.2, 51.5; 580 nm 48.8, 54.3; 640 nm 54.1, 59.2; $\text{VHN}_{20} = 291-449$.

Occurs as elongated anhedral grains averaging 40 microns in diameter and ranging from 2 to 200 microns. Associated minerals: sperrylite, $(\text{Pt,Pd})_{3\pm x}\text{Sn}$, Ag-Au alloys, chalcopyrite, pyrrhotite, magnetite, silicates.

Discussion. The mineral appears to be identical to paolovite, Pd_2Sn (*Am. Mineral.*, **59**, 1331). **L.J.C.**

Palladium Plumboarsenide



Probe analyses of two samples gave Pd 29.8, 31.8; Ag -, 1.1; Pb 50.4, 50.2; As 21.4, 19.8; totals 101.6, 102.5 percent. 18-line powder pattern indexed as orthorhombic $a = 7.180$, $b = 8.619$, $c = 10.662 \text{ \AA}$. Strongest lines 2.65 **10 004**; 2.16 **9 040,124**; 2.50 **6 104**; 2.23 **6 311**; 1.667 **6 150,044**; 1.385 **6 217**.

In reflected light (air?) the mineral is greyish white next to chalcopyrite and pale grey next to Ag-Au alloy. It is anisotropic with yellowish grey tones. R percent in air for first analysis 460 nm 54.2, 550 nm 56.9, 580 nm 57.7, 640 nm 59.6. $\text{VHN}_{20} = 241(228-250)$. Etched by 20 percent FeCl_3 , conc. HNO_3 ; weakly etched

by HgCl_2 ; negative to other reagents. Occurs as isometric, almost square, and oval crystals. Grains average 70 microns in diameter and range from 40 to 150 microns. Associated minerals: Ag-Au alloys, Pd_3Pb , $(\text{Ni},\text{Pd})_{2+x}\text{As}$, $(\text{Pd},\text{Pt})_{3+x}\text{Sn}$, and chalcopyrite.

Discussion. Single crystal study required, especially to determine if approximate As:Pb of 1:1 is significant. The uncertain stoichiometry may be due to analytical errors. L.J.C.

Newly Reported Minerals from China, I

Platinum Metal Mineral Research Group, Microprobe Analysis Laboratory, X-ray Powder Photograph Laboratory, and Mineral Dressing Laboratory, Kweiyang Institute of Geochemistry, Academia Sinica (1974) Tellurostibnide of palladium and nickel and other new minerals and varieties of platinum metals. *Geochimica*, 3, 169-181 (in Chinese with English abstract). (It is not stated whether or where type materials are preserved. GYC, LJC).

Hexastibiopalladite, Pd_4Sb_6 (=Sudburyite)

Microprobe analysis gave: Pd 41, 40; Sb 60, 58; sum 101, 98 percent, corresponding to $\text{Pd}_{3.91}\text{Sb}_{5.00}$ and $\text{Pd}_{3.94}\text{Sb}_{5.00}$.

The X-ray powder pattern is indexable on the basis of a hexagonal cell with $a = 4.07$, $c = 5.57$ Å. The strongest X-ray lines (19 given, including 3 β -lines) are: 2.970 8 101, 2.184 10 102, 2.030 6 110, 1.644 3 112, 1.490 3 202, 1.149 5 301.

Pale brownish gray, brittle, with metallic luster. Under reflected light it is yellowish white. Weakly anisotropic. Reflectance = 66.1 percent (590 nm). $\text{VHN}_5 = 210$ kg/mm², corresponding to 4.0 on Moh's scale. The mineral was found as short prismatic grains in the heavy concentrates of crushed ores.

The mineral occurs in Cu-Ni-sulfide deposits in Y (see testibiopalladite) in Southwestern China.

Discussion. The name is unnecessary as the mineral is clearly identical to sudburyite (PdSb , *Can. Mineral.* 12, 275-279, 1974). GYC, LJC.

Hexatestibiopanickeleite, $(\text{Ni},\text{Pd})_2\text{SbTe}$

Microprobe analysis gave: Ni 20, Pd 16, Sb 31, Bi 0.1, Te 33, sum 100.1 percent, corresponding to $(\text{Ni}_{1.32}\text{Pd}_{0.68})(\text{Sb}_{0.99}\text{Bi}_{0.05})\text{Te}_{1.00}$.

The X-ray powder pattern is indexable on the basis of a hexagonal cell with $a = 3.98$, $c = 5.35$ Å. Strongest X-ray lines (19 given, including 3 β -lines) are: 2.890 10 101, 2.109 8 102, 1.990 7 110, 1.635 4 201, 1.580 5 103, 1.108 6, diffuse 114.

The mineral is weakly anisotropic, pale yellow to yellowish white in reflected light. Reflectance = 58.2-62.3 percent (590 nm). $\text{VHN}_5 = 75$ kg/mm² and $\text{VHN}_2 = 108$ kg/mm², equivalent to 2.0-2.2 on Moh's scale.

The mineral occurs in Cu-Ni-sulfide deposits in Y (see testibiopalladite) in Southwestern China. In heavy concentrates of crushed ores it is often found with testibiopalladite.

Discussion. The mineral appears to be a new species and may be structurally related to imgreite (NiTe_2 , *Am. Mineral.* 49, 1151). The name is awkward. GYC, LJC.

Testibiopalladite, $\text{Pd}(\text{Sb},\text{Bi})\text{Te}$

Microprobe analysis of two grains from Y, using pure metals as standards, gave: Pd 25, 26; Ni 1, -; Sb 20, 21; Bi 19, 17; Te 35, 36; sum 100, 100 percent, corresponding to $(\text{Pd}_{0.89}\text{Ni}_{0.06})(\text{Sb}_{0.63}\text{Bi}_{0.34}\text{Te}_{1.03})$ and $\text{Pd}_{0.91}(\text{Sb}_{0.65}\text{Bi}_{0.30}\text{Te}_{1.05})$. Six analyses of material

from W gave (range): Pd 27-30.3, Ni 0-0.8, Sb 23-33.9, Bi 0-20, Te 31-39.7, sum 96.6-105.1 percent corresponding to $(\text{Pd}_{0.91-0.99}\text{Ni}_{0-0.05})(\text{Sb}_{0.72-0.97}\text{Bi}_{0-0.36}\text{Te}_{0.92-1.06})$.

The X-ray powder pattern is indexable on the basis of a cubic cell with $a = 6.572$ Å (also 6.557-6.581 Å, reflecting variations in Sb:Bi). The strongest X-ray lines (36 given, including β -lines) are: 2.940 10 210, 211 β ; 2.680 8 211; 1.983 9 311; 1.755 7 321; 1.267 6 333, 511; 1.162 6 440; 1.066 7 532, 611.

The mineral was found in concentrates of crushed ores as irregular to short prismatic grains (0.07-0.10 mm). Bright steel gray with a light brown tint, metallic luster. Surfaces are often tarnished yellowish-brown. Brittle with two sets of imperfect cleavage. In reflected light it is bright white with a faint blue tint. Isotropic, reflectance = 57.3 percent (590 nm). The mineral from W is white and sometimes milky yellow. Reflectance 480 nm, 54.4; 500 nm, 54.2; 520 nm, 54.0; 540 nm, 53.9; 560 nm, 54.0; 580 nm, 54.9; 600 nm, 54.0; 620 nm, 54.0; 640 nm, 54.0; 660 nm, 54.7 percent. $\text{VHN}_5 = 165$ kg/mm² and $\text{VHN}_{10} = 267$ kg/mm², equivalent to 3.5-4.0 on Moh's scale.

The mineral occurs as inclusions in gersdorffite-cobaltite, pyrrhotite, chalcopyrite, and pentlandite in Cu-Ni-sulfide deposits in Y, which is a serpentinite body intruded into a Permian formation of metamorphic rocks in Southwestern China. It is also found as a relatively common mineral in Cu-Ni-sulfide deposits in W, which is mainly a clinopyroxenite intruding into sandy shales and volcanics of Permian age in Northeastern China.

Discussion. The mineral is the antimony analogue of michenerite (PdBiTe), with PdSbTe as an end-member. GYC, LJC.

Unnamed Platinum Group Minerals

1. $(\text{Pd},\text{Ni})(\text{Te},\text{Sb},\text{Bi})$, reported as $(\text{Pd},\text{Ni})(\text{Sb},\text{Bi},\text{Te})$

Probe analysis gave Pd 41.2, Ni 1.1, Sb 23.0, Bi 4.3, Te 30.6, sum 100.2 percent, corresponding to $(\text{Pd}_{0.86}\text{Ni}_{0.04})(\text{Sb}_{0.42}\text{Bi}_{0.05}\text{Te}_{0.53})$. Bright yellow under reflected light. Isotropic, reflectance = 66.4 percent (590 nm), $\text{VHN}_5 = 225$ kg/mm². Only one grain has been found in Y (see testibiopalladite) as a subhedral inclusion (43 micron) in gersdorffite.

2. $\text{Pd}_2\text{Sb}_2(\text{Te},\text{Bi})$, reported as $\text{Pd}_2(\text{Sb},\text{Te})_2$

Probe analysis gave: Pd 37, Sb 41, Bi 5, Te 17, sum 100 percent, corresponding to $\text{Pd}_{2.1}(\text{Sb}_{2.0}\text{Bi}_{0.2}\text{Te}_{0.8})$. Bright white with a rose tint, Strongly anisotropic. Pleochroic: grayish blue-orange yellow. Distinct birefractance: white with a rose tint-white with a gray tint. R'_g and $R'_p = 520$ nm, 56.1, 52.4; 580 nm, 60.7, 57.4; 660 nm, 64.2, 61.2 percent. Hardness less than that of chalcopyrite. The mineral occurs in W (see testibiopalladite), as inclusions (18 microns) in chalcopyrite.

3. Ni_2SbTe_2 , reported as $(\text{Ni},\text{Pd})_2(\text{Sb},\text{Bi},\text{Te})_2$

Probe analysis gave: Ni 22, Pd 3, Sb 26, Bi 1, Te 46, sum 98 percent, corresponding to $(\text{Ni}_{1.94}\text{Pd}_{0.15})(\text{Sb}_{1.11}\text{Bi}_{0.02}\text{Te}_{1.87})$. The mineral is yellow under reflected light, isotropic (?). Reflectance = 59.8 percent (590 nm). $\text{VHN}_5 = 280$ kg/mm². Only one grain has been found in Y as an inclusion intergrown with pyrrhotite and pentlandite in gersdorffite.

4. Pd_2Sb

Probe analyses gave: Pd 63.1, 60.3, 61; Sb 37.7, 37.3, 36; sum 100.8, 97.6, 97 percent, corresponding to $\text{Pd}_{1.92}\text{Sb}_{1.00}$, $\text{Pd}_{1.85}\text{Sb}_{1.00}$, $\text{Pd}_{1.94}\text{Sb}_{1.00}$. The mineral is gray to pinkish gray with distinct birefractance. Strongly anisotropic, pleochroic: dull purple-grayish

red. Reflectance = 48.4 (520 nm), 52.8 (580 nm), 56.1 percent (660 nm). Hardness similar to that of chalcopyrite. The mineral occurs in both W (intergrown with native gold) and Y.

5. PdSb

Probe analyses gave: Pd 49.9, 50.4, 46.9, 43; Ni —, —, 0.5, 1; Sb 49.3, 50.9, 45.4, 54; Bi —, —, 4.1, —; Te —, —, 1.5, 3: sums 99.2, 101.3, 98.4, 101 percent, corresponding to $\text{Pd}_{1.15}\text{Sb}_{1.00}\text{Pd}_{1.15}\text{Sb}_{1.00}$, $(\text{Pd}_{1.08}\text{Ni}_{0.04})(\text{Sb}_{0.92}\text{Bi}_{0.05}\text{Te}_{0.03})$, and $(\text{Pd}_{0.86}\text{Ni}_{0.04})(\text{Sb}_{0.95}\text{Te}_{0.05})$. The mineral from W is rose yellow with strong bireflectance: orange yellow-bright yellowish brown. Strongly anisotropic. Pleochroic: grayish yellow-dull purple. Reflectance: 50.0 (520 nm), 52.2 (580 nm), 53.4 percent (650 nm). Hardness moderate. The mineral occurs in both W and Y as short prismatic crystals (20–50 microns) in interstices of pentlandite and silicates or as rims around pyrrhotite. The mineral was also reported to occur in X (no details given) in Northern China, associated with chalcopyrite and electrum.

6. Pd₃Te

Probe analysis gave: Pd 71.9, Te 26.7, sum 98.6 percent, corresponding to $\text{Pd}_{3.06}\text{Te}_{1.00}$. White with a yellow tint under reflected light. Weakly anisotropic. Reflectance greater than that of pyrite. Medium hardness. The mineral occurs in W as small grayish yellow grains intergrown with other tellurides of platinum and palladium.

7. (Pd,Pt)₃Te

Probe analysis gave: Pd 62.1, Pt 12.4, Te 28.6, sum 103.1 percent, corresponding to $(\text{Pd}_{2.61}\text{Pt}_{0.28})\text{Te}_{1.00}$. White with a pink tint. Weak bireflectance. Strongly anisotropic. Pleochroic: reddish brown-grayish blue. Reflectance similar to that of pyrite. Moderate hardness. Found in W with other tellurides, often intergrown with moncheite.

8. PdTe

Probe analysis gave: Pd 40.2 Hg 1.1, Bi 8.5, Te 48.8, sum 98.6 percent, corresponding to $(\text{Pd}_{0.90}\text{Hg}_{0.01})(\text{Bi}_{0.09}\text{Te}_{0.91})$. Pale yellow under reflected light. Weakly anisotropic. Pleochroic: yellow-gray. Reflectance = 56.3 (520 nm), 58.3 (580 nm), 58.0 percent (650 nm). Hardness similar to that of chalcopyrite. Found in W with other tellurides.

9. (Pd,Ni)(Bi,Te) (?)

Probe analysis gave: Pd 24.4, Ni 7.7, Bi 10.9, Te 51.4, sum 94.4 percent, corresponding to $(\text{Pd}_{0.51}\text{Ni}_{0.29})(\text{Bi}_{0.11}\text{Te}_{0.89})$. Isotropic, white in reflected light. Reflectance = 57.8 (520 nm), 57.9 (580 nm), 59.2 percent (660 nm). Harder than pyrrhotite. Found in W as cubic grains (5 × 7 microns) in pyrrhotite.

10. PdTe₂

Probe analysis gave: Pd 26.8, Sb 6.5, Bi 10, Te 58, sum 101.3 percent, corresponding to $\text{Pd}_{0.91}(\text{Sb}_{0.2}\text{Bi}_{0.2}\text{Te}_{1.6})$. Isotropic, pure white under reflected light. Reflectance = 63.8 (520 nm), 62.3 (580 nm), 66.3 percent (650 nm). Harder than chalcopyrite. Only one grain has been found in W as an euhedral tabular crystal (14 × 23 microns) in the interstices between chalcopyrite and silicates.

11. PdTe₃

Probe analysis gave: Pd 21.0, Te 78.0, sum 99.0 percent, corresponding to $\text{Pd}_{0.97}\text{Te}_{3.00}$. Weakly anisotropic, white with a rose tint under reflected light. Pleochroic: pale blue-yellowish gray. Reflectance larger than that of pyrite. Hardness similar to that of

pyrrhotite. Found in W as irregular grains (5 × 32 microns) in the interstices between pyrrhotite and silicates.

12. Pd₂(Te,As)

Probe analysis gave: Pd 61.5, Hg 6.1, Te 20.4, As 11.1, sum 99.1 percent, corresponding to $(\text{Pd}_{1.88}\text{Hg}_{0.10})(\text{Te}_{0.52}\text{As}_{0.48})$. Pale pink under reflected light. Strong bireflectance: pale pink-bright brownish yellow. Strongly anisotropic. Pleochroic; yellowish pink-bluish pink. Reflectance approaches that of sperrylite. Found in a Cu-sulfide deposit in W, often intergrown with sperrylite.

13. Pd₂(As,Sb), reported as Pd₂(Sb,As)

Probe analysis gave: Pd 73.2, Sb 9.1, Te 4.5, As 15.5, sum 102.3 percent, corresponding to $\text{Pd}_{2.17}(\text{Sb}_{0.24}\text{Te}_{0.11}\text{As}_{0.65})$. Distinctly anisotropic, gray to pale gray with a pinkish brown tint under reflected light. Pleochroic: purplish gray-pinkish gray. Reflectance = 53.6 (520 nm), 52.3 (580 nm), 51.3 percent (660 nm). Hardness approaches that of chalcopyrite. Found in W, often intergrown with native gold. Reported as a subspecies, intermediate between palladoarsenide (Pd_2As , *Am. Mineral.* **60**, 162, 1975) and the mineral Pd_2Sb found in W and Y.

Discussion. Data for all the above minerals are insufficient for full characterization. Nos. 2, 3, 6, 12 may be compositionally unique. No. 4 may be a Pt-free variety of the unnamed mineral $(\text{Pd,Pt,Ni})_2(\text{Sb,Sn})$ (*Am. Mineral.* **60**, 739; 1975). No. 5 could be sudburyite (*Can. Mineral.* **12**, 275–279, 1974). No. 7 is probably a Pt-bearing variety of No. 6. No. 8 is probably identical to kotulskite (*Am. Mineral.* **48**, 1181). Analysis of No. 9 is too poor to establish stoichiometry. No. 10 is compositionally similar to merenskyite. No. 11 appears to be unique but the composition is not known in the synthetic Pd-Te system. No. 13 appears to be antimonian palladoarsenide (*Am Mineral.* **60**, 162, 1975). GYC, LJC.

Newly Reported Minerals from China, II

Comments

It is not stated whether or where type materials are preserved. The minerals are named after type localities about which there is no information given. The mineral names are derived from Chinese characters according to the P'in-Yin Romanization System which is widely used in the People's Republic of China. However, the Wade-Giles Romanization System is more widely used in the western scientific community, and to facilitate proper pronunciation, a list of the Wade-Giles equivalents is given below:

| | |
|--------------|-----------------|
| Yixunite | Yi·hsün·ite |
| Dayingite | Ta·ying·ite |
| Xingzhongite | Hsing·chung·ite |
| Malanite | Ma·lan·ite |
| Daomanite | Tao·ma·ite |
| Hongshiite | Hung·Shih·ite |
| Guanglinite | Kuang·lin·ite |
| Fengluanite | Feng·luan·ite |
| Yanzhongite | Yen·chung·ite |
| Hongquiite | Hung·chi·ite |

(GYC)

YU TSU-HSIANG, LIN SHU-JEN, CHAO PAO, FANG CHING-SUNG, AND HUANG CHI-SHUN (1974) A preliminary study of some new minerals of the platinum group and another associated new one in platinum-bearing intrusions in a region in China. *Acta Geol. Sin.* **2**, 202-218 (in Chinese with English abstract).

Daomanite, (Cu,Pt)₂AsS₂

Electron microprobe analysis gave: Pt 45.2, Cu 20.1, As 18.8, S 15.3, sum 99.4 percent, corresponding to $Cu_{1.276}Pt_{0.928}As_{1.004}S_{1.908}$ or ideally $(Cu,Pt)_2AsS_2$. Other analyses gave: Pt 45.0, 42.2; Cu 21.0, 19.2; As 27.4, 17.3; S 13.2, 14.1; sums 106.6, 92.8 percent. The mineral is not attacked by HCl, HNO₃, or H₃PO₄.

The mineral is orthorhombic with $a = 8.085$, $b = 5.905$, and $c = 7.314$ Å. Strongest X-ray lines (41 given) are: 7.32 **70 001**, 3.20 **60 012**, 3.01 **100 211**, 209 **60 203**, 1.835 **100 123**, 1.281 **60 341**, 1.079 **80 443**, 1.003 **60 052**, 152, 0.9982 **60 444**, 0.9906 **70 605**, 643.

Color steel gray with a yellow tint, silver grayish white on fresh surfaces, luster metallic, habit tabular. Grain size 0.2-0.3 mm. Four sets of cleavages, from most to least perfect, are {100}, {010}, {001} {110}. Non-magnetic, brittle. Fracture step-like or uneven.

Under reflected light pale greenish yellow, strongly anisotropic, pleochroic: gold yellow and grayish green. Parallel extinction. *R_g* and *R_p* are: 466 nm, 40.5, 34.6; 544 nm, 43.1, 37.2; 589 nm, 44.1, 39.2; 656 nm 45.2, 37.2 percent. $VHN_{10-20} = 169-175$ kg/sq mm.

The mineral was found in the Tao and Ma (apparently code names—GYC) districts in a certain region in China. In the Tao district the occurrence and mineral associations are the same as those for yixunite and dayingite. In the Ma district, the mineral occurs in the olivine pyroxenite type of platinum ores related to Cu-sulfide mineralization, associated with olivine, diopside, serpentine, chlorite, bornite, chalcocopyrite, magnetite, pyrite, gold, sperrylite, cooperite, moncheite, cuproplatinum, polyxene, and a new mineral yanzhongite. The mineral is often found replacing bornite.

Discussion. The mineral appears to be a new species. The ideal formula, based on data reported, may also be written as $CuPtAs_2$. GYC,LJC.

Dayingite, Cu(Co,Pt)₂S₄

Electron microprobe analysis gave: Cu 17.3, Co 14.6, Pt 38.2, S 29.2, sum 99.3 percent, corresponding to $Cu_{1.19}Co_{1.08}Pt_{0.86}S_{4.00}$ or ideally $Cu(Co,Pt)_2S_4$. Two additional analyses gave: Cu 15.5, 14.0; Co 13.2, 13.0; Pt 35.1, 32.3; S 24.2, 31.7; sums 88.0, 91.0 percent.

The mineral is cubic, *Fm3m* with $a = 9.697(9)$ Å. The strongest X-ray lines (17 given) are: 5.71 **80 111**, 3.06 **80 311**, 2.435 **100 400**, 1.869 **90 511**, 1.730 **70 440**, 1.490 **40 533**, 0.9928 **50 844**, 0.8495 **40 970**.

The mineral occurs as perfect dodecahedral crystals, sometimes modified by cube (size not given). Bright white to silver white with metallic luster. Cleavage absent, brittle. Streak steel gray. White under reflected light. Reflectances are: 466 nm, 40.5; 544 nm, 41.3; 589 nm, 42.8; 656 nm, 44.5 percent. Isotropic. $VHN_{20} = 310$ kg/sq mm.

Occurrence and associated minerals are same as for yixunite.

Discussion. The mineral appears to be a new species. The ideal formula, based on data reported, may also be written as $CuCoPtS_4$, $(Cu,Co,Pt)_3S_4$ or $(Cu,Pt)_2CoS_4$. GYC,LJC.

Fengluanite, Pd₃(As,Sb) = Antimonian Guanglinite)

Electron microprobe analysis gave: Pd 76.0, Pt-, As 10.1, Sb 13.2, sum 99.3 percent, corresponding to $Pd_3(As_{0.636}Sb_{0.463})$ or

ideally $Pd_3(As,Sb)$. Other analyses gave: Pd 72.5, 79.2, 68.4; Pt -, -, 4.4; As 9.2, 10.0, 11.2; Sb 11.0, 9.5, 9.4; sums 92.7, 98.7, 93.4 percent.

The mineral is orthorhombic with $a = 11.03$, $b = 3.37$ and $c = 6.13$ Å. The strongest X-ray lines (24 given) are: 2.37 **70 302**, 2.18 **100 500**, 1.652 **30 120**, 1.640 **30 403**, 1.549 **30 221**, 1.259 **40 504**.

Color pale yellow, luster metallic. Habit platy, granular. Some grains show euhedral hexagonal crystal outline. Grain size 0.1-1 mm. The mineral has one perfect cleavage and breaks easily into perfect tabular fragments. Grain surfaces are uneven, sometimes show step-like development. Non-magnetic.

Yellow under reflected light. Weakly anisotropic. Parallel extinction. Reflectances are: 466 nm, 51.4; 544 nm, 53.6; 589 nm, 54.0; 656 nm, 56.0 percent. $VHN_{10-20} = 657-660$ kg/sq mm.

Fengluanite and guanglinite are relatively common minerals in various types of platinum ores in the basic-ultrabasic rocks, particularly in the Hung district, in a certain region in China. Occurrence and mineral associations are the same as given for hongshiite in the Hung district, and as given for yixunite, dayingite, and daomanite in the Tao district. In the Hung district the mineral is often found to replace diopside and biotite and as pseudomorphs after biotite.

Discussion. Unnecessary name for antimonian guanglinite (Pd_3As). See discussion on guanglinite. The *d* value (2.18 Å) of reflection 110 is apparently in error. GYC,LJC.

Guanglinite, Pd₃As

Electron microprobe analysis gave: Pd 80.3, Pt -, As 20.1, Sb -, sum 100.4 percent, corresponding to $Pd_3As_{1.068}$ or ideally Pd_3As .

The mineral is orthorhombic with $a = 10.83$, $b = 3.33$, and $c = 6.07$ Å. The strongest X-ray lines (26 given) are: 2.36 **70 302**, 2.18 **100 500**, 1.242 **50 504**, 0.8595 **40**, 0.8265 **50**, 0.8050 **40**, 0.7936 **40**, 0.7846 **40**.

Physical properties of guanglinite were reported to be very similar to those of fengluanite, except that guanglinite is usually massive.

Yellow under reflected light. Weakly anisotropic. Parallel extinction. Polishes well. Reflectances are: 466 nm, 45.0; 544 nm, 47.1; 589 nm, 49.4; 656 nm, 48.6 percent. $VHN_{10-20} = 635-660$ kg/sq mm.

Guanglinite occurs as a relatively common mineral in various types of platinum ores in the basic-ultrabasic rocks, particularly in the Hung district, in a certain region in China, associated with the same suite of minerals as given for hongshiite.

Discussion. The mineral appears to be unique. The powder data bear strong similarity to those of synthetic Pd_3As which is tetragonal with $a = 9.974(2)$ and $c = 4.822(2)$ Å (Saini *et al.*, 1974, *Can. J. Chem.* **42**, 620-629). Further single crystal work is necessary. GYC,LJC.

Hongquuite, TiO

Electron microprobe analysis gave: Ti 74.0, Fe 0.5, O 25 (theoretical), sum 99.5 percent, corresponding to $(Ti_{0.99}Fe_{0.01}^2)O$ (calculated by GYC) or ideally TiO. The presence of O was confirmed by probe analysis.

The mineral is cubic, *Fm3m* with $a = 4.293(5)$ Å, which is significantly larger than that of synthetic TiO ($a = 4.177$, ASTM 8-117) but is comparable to that of wustite ($a = 4.284$). The powder pattern contains seven lines: 2.479 **50 111**, 2.144 **100 200**, 1.529 **70 220**, 1.297 **50 311**, 1.081 **80 400**, 0.9850 **10 331**, 0.9600 **20 420**.

The mineral is bright white with metallic luster and occurs as perfect cubo-octahedral crystals (0.2-0.3 mm). Non-magnetic,

brittle. White with a pink tint under reflected light. Isotropic, with distinct red internal reflection. Reflectances are: 466 nm, 28.6; 544 nm, 27.5; 589 nm, 35.8; 656 nm, 32.6 percent. $VHN_{100} = 710$ kg/sq mm.

The mineral occurs in platinum ores of the garnet hornblende pyroxenite type in the Tao district in a certain region in China, associated with minerals similar to those given for yixunite and daomanite.

Discussion. The mineral appears to be unique. **GYC,LJC.**

Hongshiite, PtCuAs

Electron microprobe analysis gave: Pt 61.0, Cu 15.7, As 23.0, sum 99.7 percent, corresponding to $Pt_{1.02}Cu_{0.81}As_{1.00}$ or ideally PtCuAs.

The mineral is hexagonal with $a = 10.51$ and $c = 4.59$ Å. The strongest X-ray lines (34 given) are: 4.52 **100 200**, 2.211 **100 311**, 1.910 **100 212**, 1.361 **40 303**, 1.344 **40 512**, 1.156 **80 423**, 0.8822 **70 405,802**, 0.8591 **80 661**.

Color bronze, luster metallic, habit irregular to massive. Grain size 0.1–0.5 mm. Cleavage not observed. Non-magnetic, relatively brittle. Polishes well. White with a yellow tint under reflected light. Reflectances are: 466 nm, 48.1; 544 nm, 45.6; 589 nm, 62.1; 656 nm, 65.3 percent. $VHN_{5-20} = 483-482$ kg/sq mm.

The mineral occurs in the actinolitized diopside type of platinum deposits in the Hung (apparently a code name—GYC) district in a certain region in China, associated with diopside, actinolite, epidote, magnetite, bornite, polydymite, cooperite, sperrylite, vysotskite, and two new minerals, fengluanite and guanglinite. The mineral is often found replacing cooperite and replaced by fengluanite.

Discussion. The mineral appears to be a new species. The ideal formula, based on data reported, may also be written as $(Pt,Cu)_2As$ or $(Pt,Cu)_{2-x}As$. **GYC,LJC.**

Malanite, (Cu,Pt,Ir)S₂

Electron microprobe analysis gave: Cu 14.1, Ni 0.5, Fe 1.5, Pt 31.2, Ir 19.1, Pd 0.66, S 32.7, sum 99.76 percent, corresponding to $Cu_{0.223}Pt_{0.160}Ir_{0.099}S_{1.022}$ or ideally $(Cu,Pt,Ir)S_2$.

The mineral is cubic with $a = 6.030(9)$ Å. The strongest X-ray lines (17 given) are: 5.86 **80 100**, 3.00 **70 200**, 2.833 **60 210**, 2.501 **100 211**, 1.921 **70 310**, 1.761 **100 222**, 1.014 **50 531**, 0.7854 **70 731**.

The mineral is bright white with a faint brown tint. Habit granular. Grain size not given. Non-magnetic. Polishes well. Bright white under reflected light, isotropic.

The mineral occurs in the peridotite type of platinum ores related to Cu-Ni sulfides in a certain region in China, associated with olivine, orthopyroxenes, pyroxenes, serpentine, chlorites, pentlandite, pyrrhotite, bornite, magnetite, cooperite, sperrylite, cuproplatinum, and platinum.

Discussion. The mineral appears to be a new species. It may be related to synthetic CuS_2 , *Pa3* with $a = 5.79$ Å (Munson, 1966, *Inorgan. Chem.* **5**, 1296) and $a = 5.7897$ Å (Taylor and Kullerud, 1972, *Neues Jahrb. Mineral. Monatsh.*, 458–463); and to fukuchilite, $(Cu_3FeS_3)(Am. Mineral. **55**, 1811). **GYC,LJC.**$

Xingzhongite, (Ir,Cu,Rh)S

Electron microprobe analysis gave: Ir 47.0, Os 3.0, Pt 4.0, Rh 7.6, Cu 10.0, Fe 2.5, Pb 8.0, S 17.1, sum 99.2 percent, corresponding to $Ir_{0.524}Cu_{0.274}Rh_{0.136}Pb_{0.072}S_{1.00}$ or ideally $(Ir,Cu,Rh)S$.

The mineral is cubic or pseudocubic with $a = 8.72(1)$ Å. The strongest X-ray lines (29 given) are: 5.99 **60 110**, 3.02 **80 220**, 1.769

70 422, 1.506 **60 530**, 1.340 **60 541**, 1.208 **100 640**, 1.034 **80 822**, 1.020 **80 830**.

The mineral is steel gray with metallic luster. It often occurs as a rim (0.1 mm wide) around iridosmine. Under reflected light the mineral is bluish gray. Reflectances are: 466 nm, 40.5; 544 nm, 38.9; 589 nm, 41.1; 656 nm, 41.0 percent. Isotropic. $VHN_{60} = 753$ kg/sq mm.

The mineral occurs in the dunite type of platinum ores related to chromium mineralization in a certain region in China, associated with olivine, serpentine, talc, chromite, magnetite, and minor pyrite. Other platinum group minerals present are polyxene, osmiridium, iridosmine, osmium, iridium, erlichmanite, cooperite, irarsite, osarsite, unnamed Ir-Ni sulfide, unnamed Os-Ni disulfide, unnamed Rh-Ir disulfide.

Discussion. The mineral appears to be a new species. The ideal formula, based on data reported, may also be written as $Ir(Cu,Rh,Pb)S_2$. **GYC,LJC.**

Yanzhongite, PdTe-PdTe_{1-x} (= Kotulskite)

Electron microprobe analysis of five grains gave (range): Pd 45.0–48.6, Te 49.1–52.0, Bi–5.5, sum 99.3–103.3 percent, corresponding to $Pd_{1.00}Te_{0.842-0.958}Bi_{0-0.060}$ or ideally, $PdTe-PdTe_{1-x}$. Two other analyses gave low sums (88.7 and 90.5 percent). Analysis of argentinian varieties gave: Pd 42.0, 41.4; Te 52.6, 52.6; Bi 2.2, –; Ag 3.7, 5.3; sums 100.5, 99.3 percent, corresponding to $Pd_{0.92}Ag_{0.079}Te_{0.962}Bi_{0.023}$ and $Pd_{0.888}Ag_{0.111}Te_{0.940}$. Analysis of an Hg-bearing variety gave: Pd 40.3, Te 52.7, Hg 7.7, sum 100.7 percent, corresponding to $Pd_{0.908}Hg_{0.091}Te_{0.992}$.

The mineral is hexagonal with $a = 4.12$ and $c = 5.62$ Å. The strongest X-ray lines (15 given) are 3.037 **100 101**, 2.848 **80 002**, 2.222 **70 102**, 2.094 **80 110**, 2.014 **60 201**, 1.530 **60 202**.

The mineral was only found in polished sections, as droplets near the margin of bornite or in vein minerals such as hornblende. A few grains show hexagonal cross-sections. Grain size several tens of microns up to 0.1 mm.

Pale yellow under reflected light. Birefractance not observed. Strongly anisotropic, pleochroic: pale bluish, grayish white to dark grayish yellow. Hardness less than that of bornite. Polishes well. Reflectances are: 466 nm, 53.7; 544 nm, 60.0; 589 nm, 62.5; 656 nm, 63.2 percent. $VHN_5 = 15.8$ kg/sq mm. Reflectances and VHN's given for Hg-, Ag-, and Bi-bearing varieties are somewhat different.

The mineral occurs in the garnet hornblende pyroxenite type of platinum ores in the Tao district, and in the olivine pyroxenite type of platinum ores in the Ma district, associated with minerals similar to those given for daomanite. In the Tao district the mineral is closely associated with bornite and is often found to replace bornite.

Discussion. Unnecessary name for kotulskite (*Am. Mineral.* **48**, 1181). The d value (2.014) of reflection 201 is apparently in error. **GYC-LJC.**

Yixunite, PtIn

Electron microprobe analysis gave: Pt 66.0, In 33.5, sum 99.5 percent, corresponding to $Pt_{1.00}In_{0.86}$ or ideally PtIn. The mineral is not attacked by HCl, HNO_3 , or H_3PO_4 .

The mineral is cubic, *Fm3m* with $a = 3.948(5)$ Å. The powder pattern contains nine lines: 2.294 **50 111**, 1.991 **70 200**, 1.395 **50 220**, 1.187 **100 311**, 1.140 **30 222**, 0.9873 **20 400**, 0.9048 **40 331**, 0.8820 **50 420**, 0.8057 **60 422**.

Color bright white with a blue tint, luster metallic, cleavage ab-

sent, non-magnetic. Mineral grains are rounded (size not given). Under reflected light the mineral is bright white with a slight yellow tint, isotropic. Reflectances are: 466 nm, 67.0; 544 nm, 63.9; 589 nm, 78.5; 656 nm, 75.8 percent. $VHN_{10} = 159.4$ kg/sq mm.

The mineral occurs in the garnet hornblende pyroxenite type of platinum ores related to Cu-sulfides in the Tao (GYC: apparently a code name) district in a certain region in China, associated with almandine, hornblende, diopside, augite, plagioclase, sphene, apatite, chalcopyrite, bornite, magnetite, covellite, carrollite, goethite, columbite, cooperite, sperrylite, moncheite, and other new minerals fengluanite, dayingite, yanzhongite, daomanite, and hongquite.

Discussion. The mineral appears to be a new species but the synthetic compound PtIn has not been reported for the Pt-In system. GYC,LJC.

Unnamed Sulfides of Ir, Os, Rh, Ni

(1) $(Ni_{0.75}Ir_{0.25})S$

Electron microprobe analysis gave: Ir 41.0, 39.0; Os 2.0, 2.5; Ni 14.3, 11.5; Fe 11.0, 10.1; Cu 5.7, 4.5; Co 2.8, 0.7; S 24.5, 21.5; sum 101.4, 89.9 percent, the former corresponding to $Ir_{0.291}Ni_{0.317}Fe_{0.258}Cu_{0.117}Co_{0.061}S_{1.00}$, or ideally $(Ni_{0.75}Ir_{0.25})S$ or $(Ni,Fe,Cu)_{0.75}Ir_{0.25}S$.

The strongest X-ray lines (45 given, unindexed) are: 3.33 **100**, 2.982 **80**, 2.894 **75**, 2.798 **60**, 2.046 **60**, 1.917 **80**, 1.748 **100**, 1.022 **50**.

Reddish brown in reflected light. Strongly anisotropic, pleochroic: pale blue-fire red. Reflectances are: 466 nm, 46.9; 544 nm, 43.7; 589 nm, 43.4; 656 nm, 43.1 percent. $VHN_{20} = 642$ kg/sq mm. Cleavage not observed. Polishes well.

The mineral occurs as rims around osmiridium, associated with polyxene, erlichmanite, irarsite and other minerals in chromium ores in dunite.

(Khuniite = Iranite)

S. A. WILLIAMS (1974) The naturally occurring chromates of lead. *Bull. Brit. Museum (Nat. Hist.), Mineral*, **2**, 377-419.

Iranite was described as $PbCrO_4 \cdot H_2O$ (*Am. Mineral.* **48**, 1417), but new analyses of type material show CuO 4.59, ZnO 0.20 percent (Sebarz, Iran); CuO 2.29, ZnO 0.43 percent (Seh-Changi, Iran). The X-ray data for these match closely those for hemihedrite

(2) $(Ir,Rh,Ni)S$

Electron microprobe analysis gave: Ir 59.0, Rh 14.2, Pt 3.5, Ni 4.9, S 17.5, sum 99.1 percent, corresponding to $Ir_{0.56}Rh_{0.252}Pt_{0.034}Ni_{0.155}S_{1.00}$ or ideally $(Ir,Rh,Ni)S$.

Bluish gray under reflected light. Strongly anisotropic. Pleochroic: dull red-bluish green. Reflectances are: 466 nm, 40.8; 544 nm, 39.5; 589 nm, 37.8; 656 nm, 41.5%. $VHN_{20} = 1650$ kg/sq mm.

The mineral occurs in chromium ores of the dunite type, as exsolution product in osmiridium.

(3) $(Os,Ni)S_2$

Electron microprobe analysis gave: Os 48.5, Ni 15.0, Ru 5.0, S 31.7, sum 100.2 percent, corresponding to $Os_{0.537}Ni_{0.530}Ru_{0.013}S_{2.00}$.

Color bluish gray under reflected light. Isotropic with high relief. Reflectances are: 466 nm, 42.0; 544 nm, 44.5; 589 nm, 43.7; 656 nm, 38.9 percent. $VHN_{50} = 2575$ kg/sq mm.

The mineral occurs as worm-like exsolution product (0.09 × 0.02 mm) in osmiridium in the chromium ores of the dunite type.

(4) $(Ir,Rh)S_2$

Electron microprobe analysis gave: Ir 58.0, Rh 14.5, S 29.5, sum 102.0 percent, corresponding to $Ir_{0.676}Rh_{0.304}S_{2.00}$ or ideally $(Ir,Rh)S_2$. Bluish gray under reflected light. Isotropic with high relief. Reflectances are: 466 nm, 45.1; 544 nm, 48.1; 589 nm, 51.3; 656 nm, 47.1 percent. $VHN_{50} = 2300$ kg/sq mm.

The mineral occurs as euhedral rhombohedral crystals (10 microns) in a matrix of polyxene in the chromium ores of the dunite type.

Discussion. $(Ni_{0.75}Ir_{0.25})S$ may be structurally unique if X-ray data reported were from pure material. $(Ir,Rh,Ni)S$ and $(Ir,Rh)S_2$ are compositionally unique. $(Os,Ni)S_2$ may be a nickeloan erlichmanite. On the other hand, the near 1:1 ratio of Os:Ni may be structurally significant. We agree with the authors' statement that further studies are necessary for full characterization. GYC, LJC.

NEW DATA

(*Am. Mineral.* **55**, 1088-1102), and iranite is probably the Cu analog of hemihedrite, with a series probably existing. Khuniite (*Am. Mineral.* **55**, 1813, **58**, 562; **59**, 633) is iranite, not hemihedrite. M.F.

Errata

Am. Mineral. **60**, 488. In the discussion of natrofairchildite, "one percent cleavage" should read "one perfect cleavage."