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NEW MINERAL NAMES*

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Iridrhodruthenium

Shuihe Mao, Xuecui Zhou (1989) Iridrhodruthenium and its matrix mineral—isoferroplatinum. Acta Mineral. Sinica, 9(2), 136–140 (in Chinese, English abstract).

The average and (range) of six electron-microprobe analyses gave Ru 54.26 (53.62–54.79), Rh 14.69 (13.76–16.13), Ir 19.32 (18.77–20.58), Pt 11.06 (10.17–11.83), Os 0.68 (0.00–1.50), sum 100.01 (99.98–100.02) wt%, corresponding to $Ru_{6.38}Rh_{1.70}Ir_{1.20}Pt_{0.68}Os_{0.04}$; Ru, Rh, and Ir each >10 atomic %, and the mineral therefore is a three-element alloy. Ru-Ir-Rh-Pt are homogeneously distributed. The mineral occurs as exsolved leaf- or branch-shaped grains, 10–50 μm long and 1–3 μm wide, in isoferroplatinum. In reflected light, bright yellowish white with a creamy tint; distinct bireflectance from bright white with a creamy tint to white with a light yellow tint. Reflectance parallel to elongation higher than that of isoferroplatinum, similar to isoferroplatinum when normal to elongation. Anisotropic from brownish pink to violet-gray. H = ~isoferroplatinum. Insoluble in hot 1:1 HNO_3-HCl.

The mineral typically occurs with isoferroplatinum and laurite in chromite ore in Alpine-type ultrabasic rocks in northern Tibet. The new name is derived from the chemical composition. Type material is at the Institute of Comprehensive Utilization of Mineral Resources, Ministry of Geology and Mineral Resources, Emei, Sichuan (Szechwan) Province, China.

Discussion. A new name would be valid if the system of nomenclature in use for the Ru-Ir-Os ternary were to be extended to the Ru-Ir-Rh ternary. Such an extension has not been approved, and the new name should not have been introduced. Compositions of the mineral plot within the uncomplicated, main field for ruthenium in the Ru-Ir-Rh ternary (a miscibility gap appears for compositions with substantially higher Ir and Rh contents); accordingly, the appropriate mineral name is ruthenium. **J.L.J.**

Kochkarite*

E.M. Spiridonov, N.A. Ershova, O.I. Tananaeva (1989) Kochkarite $PbBi_4Te_7$—A new mineral from contact metamorphosed ores. Geol. Rudnykh Mestorozhdenii, 31(4), 98–102 (in Russian).

Analysis by electron microprobe gave Bi 44.01, Pb 11.18, Sb 0.05, Ag 0.24, Te 46.68, Se 0.17, sum 102.33 wt%, corresponding to $(Pb_{1.02}Ag_{0.04})_{\Sigma 1.06}(Bi_{3.98}Sb_{0.01})_{\Sigma 3.99}(Te_{6.91}Se_{0.04})_{\Sigma 6.95}$, ideally $PbBi_4Te_7$. The mineral forms platy tabular crystals, often curved, measuring up to 10 × 10 × 3 mm. Silver-gray with bright metallic luster, lead-gray streak, tarnishes in air, perfect basal cleavage; fragments are flexible, not elastic. $H = 28–80$ kg/mm^2 (10–20 g load), Mohs 2–2½, melts ~580 °C. In reflected light, white with pink tones, strongly anisotropic, clearly bireflectant. Reflectance measurements (nm, R_{max}%, R_{min}%): 400 61.3, 58.2; 420 61.5, 58.5; 440 61.6, 58.6; 460 61.7, 58.7; 480 61.9, 58.7; 500 62.4, 58.8; 520 62.9, 58.8; 540 63.2, 59.0; 560 63.6, 59.2; 580 64.0, 59.5; 600 64.4, 59.8; 620 64.8, 60.2; 640 65.1, 60.6; 660 65.6, 61.1; 680 66.0, 61.7; 700 66.3, 62.1. X-ray powder-diffraction study showed the mineral to be trigonal, space group $P\bar{3}m1$, $a = 4.416(8)$, $c = 72.09(10)$ Å, $D_{calc} = 7.89$, $D_{meas} = 7.94(3)$ g/cm^3 with $Z = 3$. The strongest lines (16 given) are 3.228(100,1.0.12), 2.364(58,1.0.24), 2.212(19,110), 2.005(33,0.0.36), and 1.983(18,1.1.16).

The mineral occurs in quartz and quartz-carbonate veins of the Kochkar deposit, Southern Urals, intergrown with galena and associated with aleksite, rucklidgeite, wittite, pyrrhotite, gold, and an unnamed $Pb_5Bi_5Te_3S_7$ phase. This assemblage occurs in the hornblende hornfels zone of a contact metamorphic aureole and apparently has developed from a pre-existing assemblage preserved in a more weakly metamorphosed zone containing galena, tetradymite, tellurobismuthite, bismuthinite, and altaite. The mineral is named for the Kochkar deposit. Type material is at the Fersman Mineralogical Museum, Moscow. **D.A.V.**

Leningradite*

L.P. Vergasova, S.K. Filatov, T.F. Semenova, V.V. Anan'ev (1990) Leningradite $PbCu_3(VO_4)_2Cl_2$—A new mineral from volcanic sublimates. Doklady Akad. Nauk SSSR, 310(6), 1434–1437 (in Russian).

Microprobe analysis (average of 10) gave PbO 32.13, CuO 32.84, ZnO 0.32, V_2O_5 26.22, As_2O_5 0.49, Cl 9.60, O ≡ Cl_2 2.17, sum 99.43 wt%, corresponding to $Pb_{1.01}(Cu_{2.89}Zn_{0.03})_{\Sigma 2.92}[(V_{1.01}As_{0.01})_{\Sigma 1.02}O_4]_2(Cl_{1.90}O_{0.10})_{\Sigma 2.00}$, ideally

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

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$PbCu_3(VO_4)_2Cl_2$. Insoluble in water and stable in air up to 425 °C, where it breaks down chiefly to vanadinite. The mineral occurs as rhombic tablets or flakes up to 0.3 mm maximum dimension and in globules up to 0.6 mm in diameter. The latter may have either a radial or tangential internal orientation of crystals. Crystals are red, vitreous luster, orange-red streak, perfect {010} cleavage, well-developed {010} pinacoid, subordinate {101} prism, and {100} and {001} pinacoids. Interfacial angle of the prism is 87.9(5)° (calc. 87.8°). Brittle, H_{10} = 247 (180–345) kg/mm², Mohs 4.25; D_{meas} = 4.8(1), D_{calc} = 4.97 g/cm³ with $Z = 4$. In transmitted light, transparent, red with gold tones, no dispersion, parallel or symmetric extinction, biaxial negative, optic plane (100), $2V$ large. No pleochroism in (010) sections; $Z = c$, $Y = a$, $X = b$, α not determined because all grains were {010} cleavage sections, $\beta = 2.29(1)$, $\gamma = 2.35(1)$. Single-crystal X-ray studies showed the mineral to be orthorhombic, space group *Ibam*, $a = 8.988(2)$, $b = 11.083(2)$, $c = 9.360(6)$ Å. The most intense lines (45 given) of the powder pattern are 5.545(49,020), 3.489(34,220), 3.418(100,130), 3.242(62,202), 2.763(95, 040,132), 2.548(66,141), 2.358(73,240), and 1.847(49, 060).

The mineral is a product of fumarolic activity at the Great Tolbachik fissure eruption (1975–1976), Kamchatka, USSR, associated with anglesite, hematite, lammerite, and tolbachite. The new name is for the city of Leningrad, USSR, where many such volcanic sublimates have been described. Type material is at the Mining Museum of the Leningrad Mining Institute, Leningrad, USSR. **D.A.V.**

Titanium

V.A. Trumilina, S.P. Roev, V.F. Makhoto, N.V. Zayakina (1988) Native titanium in granitic rocks of the Bezymyannyy massif, eastern Yakutia. Doklady Akad. Nauk SSSR, 303(4), 948–951 (in Russian, English translation available).

Five electron-microprobe analyses of an irregular flake, 1.2 × 0.8 × 0.3 mm, gave Ti 98.868 to 100.151 wt%. The grain has rough, step-like edges, silver-gray color, metallic luster, black streak, rough to hackly fracture, malleable, VHN_{20} = 188–197, VHN_{50} = 164–192, D_{meas} = >4.2, D_{calc} = 4.53 g/cm³ with $Z = 2$. White in reflected light, no internal reflection, slightly anisotropic. Reflectance values (WTiC standard) are given in 20-nm steps; representative R_{max} and R_{min} values are 440 42.0, 39.0; 480 45.3, 41.4; (520 not given); 540 48.5, 45.0; 580 50.8, 47.0; 620 52.3, 48.5; 680 54.3, 50.5. An X-ray powder pattern (57.3-mm camera, Cu$K\alpha$ radiation) gave strongest lines of 2.552(20,010), 2.364(30,002), 2.240(100,011), 1.723(20,012), 1.471(20,110), 1.331(30,103,200), and 1.244(20,112) Å, in good agreement with data for synthetic titanium (PDF 5-682). Cell dimensions calculated from the powder pattern are $a = 2.95(1)$, $c = 4.69(1)$, hexagonal symmetry, space group $P6_3/mmc$.

The mineral was recovered in a heavy-mineral separate prepared from leucocratic granite taken from the margin of the Bezymyannyy pluton, eastern Yakutia, USSR, near its contact with clayey clastic rocks. To confirm the occurrence, a second sample was collected two years later, and another flake, 1 × 0.4 × 0.2 mm, was found in the heavy-mineral concentrates. The flake contains inclusions of quartz and sodic plagioclase. The separates also contain native tin, lead, copper, iron, zinc, nickel, gold, aluminum, and tin-antimony and copper-zinc compounds.

Discussion. The new name has not been approved by the CNMMN. The occurrence of a multitude of native elements in a granitic environment is most unusual. The authors attribute the origin to "an inversion of the redox conditions, which led to the formation of various native metals and intermetallic compounds as intergrowths with rock-forming minerals of the late magmatic stage." The occurrence of native titanium has been reported previously, most recently as a component of cosmic dust (*Am. Mineral.*, 75, p. 1213, 1990). **J.L.J.**

Vasilite*

A.V. Atanosov (1990) Vasilite, $(Pd,Cu)_{16}(S,Te)_7$, a new mineral species from Novoseltsi, Bulgaria. Can. Mineral., 28, 687–689.

Electron-microprobe analyses of five grains gave Pd 76.91–77.59, Cu 7.98–10.01, S 10.66–11.78 Te 2.50–3.89, sum 99.72–101.68 wt%, corresponding to an average of $(Pd_{13.46}Cu_{2.70})_{\Sigma 16.16}(S_{6.40}Te_{0.44})_{\Sigma 6.84}$, ideally $(Pd,Cu)_{16}(S,Te)_7$. The mineral occurs as irregular to platy grains up to 100 μm long and 35 μm wide, with bowieite and troilite as a component of oval or spherical polymineralic inclusions in a matrix of isoferroplatinum. Brittle, metallic luster, black streak, VHN_{10} = 486.1 (467.2–504.9), VHN_{20} = 489.4 (473.5–507.3), D_{calc} = 8.796 g/cm³ with $Z = 2$. Creamy with a yellowish tint in reflected light in air and in oil. Bireflectance and anisotropism not observed. Reflectance percentages (Si standard) are given in 20-nm steps for 420 to 700 nm in air and in oil; respective representative values are 420 45.6, 29.9; 460 42.0, 26.3; 500 38.9, 23.4; 540 37.7, 22.1; 580 38.0, 22.4; 620 40.6, 25.1; 660 43.9, 28.4; 700 47.1, 31.6. The X-ray powder pattern (57.3-mm Gandolfi camera, Cu radiation) was indexed on a cubic cell, $a = 8.922(1)$ Å, space group $I\bar{4}3m$ by analogy to synthetic $Pd_{16}S_7$; strongest lines are 3.638(80,211), 2.389(100,321), 2.100(80,330), 1.446(80, 532), 1.214(70,552), 1.010(70,752), 0.851(70,765), 0.808(70,873), and 0.795(70,963).

The mineral occurs, with numerous others of the platinum group, in heavy-mineral concentrates obtained from clastic sediments (sands, gravels, bentonite clays) near the village of Novoseltsi, Bourgas region, southeastern Bulgaria. The new name is for Dr. Vasil Atanasov (1933–) of the Higher Institute of Mining and Geology, Sofia. Type material is in the National Museum of Earth and Man, Sofia, Bulgaria. **J.L.J.**

Ximengite*

Jiaxin Shi (1989) Ximengite—A new mineral. Acta Mineralogica Sinica, 9(1), 15–19 (in Chinese, English abstract).

Electron-microprobe analysis gave Bi_2O_3 76.34, P_2O_5 22.92, sum 99.26 wt%, corresponding to $Bi_{1.01}P_{0.90}O_4$, ideally $BiPO_4$. The mineral occurs as earthy, veinlet-type to irregular granular aggregates of grains <0.001 to 0.1 mm in size. Colorless, white streak, vitreous to greasy luster, $H = 281$ (279–283) kg/mm², brittle, non-magnetic, $D_{calc} = 5.53$ g/cm³ with $Z = 3$, yellowish green fluorescence under the electron beam. In transmitted light, transparent, colorless, uniaxial positive, refractive indices >1.78. TGA, DTA, and infrared curves indicate that the mineral does not contain (OH) or structurally bound water. Comparison with X-ray powder data for the synthetic equivalent indicates that the mineral is hexagonal, space group $P3_121$, $a = 6.9860$, $c = 6.4753$ Å by least-squares refinement. Strongest lines of the powder pattern are 6.052(73), 4.4198(91), 3.4930(88), 3.0244(100), and 2.8537(65). On heating to 900–1100 °C, inverts to a monoclinic form, then to another form that has a monazite-type structure.

The mineral occurs as an alteration of bismuthinite containing waylandite and monazite; also present are unnamed $Bi_2(PO_4)(OH)_3$(?) and $Bi_2(SO_4)(OH)_4$(?). The bismuthinite is irregularly distributed in cassiterite-tourmaline-quartz and K-feldspar rock in the Ximen tin mining district about 420 km southwest of Kunming, Yunnan Province, China. The new name is for the locality. Type material is in the Bureau of Geology and Mineral Resources, Yunnan Province. **J.L.J.**

$Au_3(Ag,Pb)As_2Te_3$

J.D. Grice, A.W.R. Bevan (1989) Frohbergite, unnamed $Au_3(AgPb)As_2Te_3$, and related tellurides from the North Kalgurli mine, Western Australia. Australian Mineral., 4, 133–140.

Electron-microprobe analyses of two anhedral grains, each less than 20 μm across and in separate polished sections, gave Au 47.1, 47.4, Ag 5.6, 5.4, Pb 5.9, 6.0, Te 30.3, 30.4, As 11.6, 11.4, Sb 0.2, 0.2, sum 100.7, 100.8 wt%, corresponding to $Au_{3.02}(Ag_{0.64}Pb_{0.36})_{\Sigma 1.00}(As_{1.94}Sb_{0.02})_{\Sigma 1.96}Te_{3.00}$, ideally $Au_3(Ag,Pb)As_2Te_3$. In reflected light, isotropic, distinctly mauve relative to altaite, and slightly mauve-gray relative to coloradoite. Reflectance values at the four standard wavelengths are 45.7, 47.7, 46.5, and 46.3%. The mineral occurs as rims on coloradoite, associated with pyrite, gold, calaverite, tetrahedrite, and pyrite in one of the sections. The unidentified mineral is from the North Kalgurli mine at Femiston, Kalgoorlie gold field, Western Australia. Other tellurides identified in the assemblage are petzite and frohbergite. **J.L.J.**

$AuPb_2BiTe_2S_3$

V.A. Kovalenker, M.A. Zalibekyan, I.P. Laputina, V.S. Malov, S.M. Sandomirskaya, M.I. Garas'ko, Dzh.V. Mkhitaryan (1990) Sulfide-telluride mineralization of the Megradzor ore field, Armenia. Geol. Rudnykh Mestorozhdeniy, No. 3, 65–81 (in Russian; Engl. transl. in Internat. Geol. Rev., 32, 705–720, 1990.

Electron-microprobe analyses of three grains gave Au 16.92, 16.17, 17.17, Pb 35.18, 36.68, 37.94, Bi 17.64, 16.45, 15.29, Te 22.21, 22.65, 22.08, S 8.16, 7.95, 8.46, sum 100.11, 99.90, 100.92 wt%, idealized as $AuPb_2BiTe_2S_3$. Platy, pale gray in reflected light, highly reflective and distinctly anisotropic. Occurs intimately intergrown with calaverite, tetradymite, and native gold, with krennerite-sylvanite solid solution, gold, and tetradymite, or with native gold alone in quartz-carbonate veins that cut Tertiary volcanics.

Discussion. The composition is similar to that of an unnamed Au-Pb-Bi sulfotelluride abstracted in *Am. Mineral.*, 73, p. 932, 1988. **J.L.J.**

$(Ni,Cu)_2Sb$, Ni_3Sb, Ni_7As_3, Pt oxide(?)

G.T. Nixon, L.J. Cabri, J.H.G. Laflamme (1990) Platinum-group-element mineralization in lode and placer deposits associated with the Tulameen Alaskan-type complex, British Columbia. Can. Mineral., 28, 503–535.

$(Ni,Cu)_2Sb$, Ni_3Sb, Ni_7As_3

Electron-microprobe analysis of a grain, 5 × 20 μm, gave Ni 31.1, Cu 11.8, Fe 0.90, Ir 7.0, Pt 0.24, Rh 0.79, Sb 47.8, sum 99.63% wt%, corresponding to $(Ni_{1.36}Cu_{0.48}Ir_{0.09}Fe_{0.04}Rh_{0.02})_{\Sigma 1.99}Sb_{1.01}$, ideally $(Ni,Cu)_2Sb$. The mineral is complexly intergrown with platinian copper and irarsite enclosed in chromite.

Analysis of a grain, 7 × 12 μm, gave Ni 57.6, Cu 0.26, Fe 0.66, Sb 40.5, sum 99.02 wt%, corresponding to $(Ni_{2.95}Fe_{0.04}Cu_{0.01})_{\Sigma 3.00}Sb_{1.00}$, ideally Ni_3Sb. The mineral occurs with platinian copper and an unidentified Ni arsenide-sulfide in a complex polymetallic grain surrounded by magnetite in serpentine.

Analyses of two grains, 5 × 8 and 10 × 23 μm, gave Ni 58.8, 60.8, Cu 0.22, 0.37, Fe 4.1, 1.5, As 33.3, 34.3, Sb 3.2, 1.9, sum 99.62, 98.87 wt%, corresponding to $(Ni_{6.47}Fe_{0.47}Cu_{0.02})_{\Sigma 6.96}(As_{2.87}Sb_{0.17})_{\Sigma 3.04}$ and $(Ni_{6.72}Fe_{0.17}Cu_{0.04})_{\Sigma 6.93}(As_{2.97}Sb_{0.10})_{\Sigma 3.07}$, respectively, ideally Ni_7As_3. The smaller grain is associated with platinian copper, Ni sulfide, and PtFe alloy as a polymineralic grain in magnetite. The larger of the two grains is associated with Ni antimonide, platinian copper, and geversite as a polymineralic grain enclosed in magnetite-chromite.

Pt oxide(?)

Electron-microprobe analysis gave Pt 78.7 (range 76.2–80.3), Rh 0.28, Ir 0.92 (0.59–1.3), Fe 0.33, Cu 4.1 (3.5–4.7), Ni 4.4 (3.0–5.5), Sb 2.6 (2.1–3.0), O 8.67 (by difference), sum 100 wt%. Occurs as a 150-μm grain associated with antimonides, platinian copper, and nickel oxide(?) and as rims on breithauptite.

The antimonides, arsenide, and Pt oxide(?) occur in chromitites in the dunite core of the Tulameen complex, about 25 km from Princeton, southern British Columbia. **J.L.J.**

(Ni-Fe-Rh-Cu-Ir)S, Ru-Fe alloys

B. McElduff, E.F. Stumpfl (1990) Platinum-group minerals from the Troodos ophiolite, Cyprus. Mineral. Petrology, 42, 211–232.

Electron-microprobe analysis of a 6-μm grain gave Ir 18.18, Os 0.01, Rh 11.75, Pt 7.23, Pd 3.38, Ni 16.05, Cu 6.77, Fe 9.77, As 0.33, S 27.13, sum 100.60 wt%, corresponding to $(Ni_{0.33}Fe_{0.21}Rh_{0.14}Cu_{0.13}Ir_{0.11}Pt_{0.04}Pd_{0.04})S$. The grain is part of a composite 18-μm inclusion also containing bornite, a Pt-Ir sulfide, and laurite.

Analysis of an inhomogeneous 10-μm grain, hexagonal in outline and slightly variable in reflectance, gave Ru 42.59, Os 5.78, Ir 4.08, Rh 0.11, Pt 0.01, Pd 1.16, Ni 0.87, Fe 41.20, As 0.63, S 0.83, sum 97.26 wt%, corresponding to $(Ru_{0.34}Os_{0.02}Ir_{0.02}Ni_{0.01})_{\Sigma 0.39}(Fe_{0.59}S_{0.02})_{\Sigma 0.61}$. Reflectance variation is thought to be related to differences in Os-Ir contents.

Analysis of a homogeneous 14-μm elongate, rhombic-shaped grain gave Ru 29.67, Os 10.44, Ir 3.54, Rh 0.48, Pd 1.28, Ni 0.11, Fe 50.90, As 0.69, S 0.78, sum 97.89 wt%, corresponding to $(Ru_{0.22}Os_{0.04}Ir_{0.01})_{\Sigma 0.27}(Fe_{0.71}S_{0.02})_{\Sigma 0.73}$. Similar Ru-Fe alloys have been reported by Stockman and Hlava [see *Am. Mineral.*, 74, p. 1216, 1989] in ophiolitic chromitite from Oregon.

Discussion. (Ni,Ir,Fe)S also is reported by Corrivaux and Laflamme (abstracted in this series). **J.L.J.**

(Ni,Ir,Fe)S, Cu(Pt,Ir,Rh)$_2$S$_4$, RhNiAs, Ru$_3$As, Rh$_2$SnCu

L. Corrivaux, J.H.G. Laflamme (1990) Mineralogy of platinum-group elements in chromitites in ophiolites at Thetford mines, Quebec. Can. Mineral., 28, 579–595 (in French, English abstract).

(Ni,Ir,Fe)S

Occurs as a single area about 6 μm in diameter, in a grain enclosed in chromite and consisting of laurite, unidentified Cu-Pt-S, and chalcopyrite(?). Electron-microprobe analysis gave Ni 17.6, Ir 22.4, Fe 6.8, Cu 6.3, Rh 7.6, Pt 12.7, S 26.6, sum 100 wt%, corresponding to $(Ni_{0.37}Ir_{0.15}Fe_{0.15}Cu_{0.12}Rh_{0.09}Pt_{0.08})_{\Sigma 0.96}S_{1.03}$.

Cu(Pt,Ir,Rh)$_2$S$_4$

This is the unidentified Cu-Pt-S mentioned above; size about 4 μm. Electron-microprobe analysis gave Cu 11.8, Fe 1.4, Ni 1.4, Pt 36.5, Ir 21.4, Rh 4.7, S 23.6, sum 100.8 wt%, corresponding to $(Cu_{0.99}Fe_{0.13}Ni_{0.13})_{\Sigma 1.25}(Pt_{1.00}Ir_{0.59}Rh_{0.24})_{\Sigma 1.83}S_{3.92}$.

RhNiAs

Six grains ranging from 1 to 7 μm in size have been recognized. Electron-microprobe analysis of the largest grain (results are given for 3 grains) gave Rh 42.3, Ni 24.3, Fe 2.2, S 30.9, sum 99.7 wt%, corresponding to $Rh_{0.97}(Ni_{0.97}Fe_{0.09})_{\Sigma 1.06}As_{0.97}$, ideally RhNiAs or (Rh,Ni)$_2$As. Possibly the rhodium analogue of majakite, PdNiAs.

Ru$_3$As

Known as a single grain about 15 μm in diameter, a large part of which appears to be either altered or a microcrystalline intergrowth. Electron-microprobe analysis gave Ru 52.0, Os 10.6, Fe 3.1, Rh 4.3, Ir 7.5, Ni 2.1, Cu 0.5, As 17.8, Sb 2.1, sum 100 wt%, corresponding to $(Ru_{2.05}Os_{0.22}Fe_{0.22}Rh_{0.17}Ir_{0.16}Ni_{0.14}Cu_{0.03})_{\Sigma 2.99}(As_{0.95}Sb_{0.07})_{\Sigma 1.02}$; the ideal formula may be Ru$_3$As.

Rh$_2$SnCu

Three grains, 2 to 10 μm in size, have been found. Analyses of two grains gave Rh 43.8, 44.4, Pd 5.5, 4.0, Ni 0.7, 1.4, Pt 1.9, 2.2, Sn 29.6, 29.1, Sb 1.0, 0.4, As –, 0.5, Cu 15.6, 15.0, Fe 0.7, 1.3, corresponding to $(Rh_{1.68}Pd_{0.20}Ni_{0.04}Pt_{0.04})_{\Sigma 1.96}(Sn_{0.98}Sb_{0.03})_{\Sigma 1.01}(Cu_{0.97}Fe_{0.05})_{\Sigma 1.02}$ and $(Rh_{1.70}Pd_{0.15}Ni_{0.09}Pt_{0.04})_{\Sigma 1.98}(Sn_{0.96}Sb_{0.01}As_{0.02})_{\Sigma 0.99}(Cu_{0.93}Fe_{0.09})_{\Sigma 1.02}$. The ideal formula may be Rh$_2$SnCu, the rhodium analogue of cabriite, Pd$_2$SnCu.

The minerals have been found in chromitite occurrences 3 to 8 km south, southeast, and east of Black Lake in the Thetford Mines area, southern Quebec. About 20 platinum-group minerals have been identified in the chromitites. (Ni,Ir,Fe)S and Cu(Pt,Ir,Rh)$_2$S$_4$ are considered to be primary magmatic phases, whereas the other three are thought to be secondary minerals formed by alteration of primary phases during serpentinization.

Discussion. A mineral with the composition RhNiAs is also reported by Hagen et al. (abstracted in this series); (Ni,Fe,Rh,Cu,Ir)S is reported by McElduff and Stumpfl (this series). Cu(Pt,Ir,Rh)$_2$S$_4$ corresponds to malanite (J.H.G. Laflamme, personal communication). **J.L.J.**

Pd(Sb,Te,Bi)

G. Beaudoin, R. Laurent, D. Ohnenstetter (1990) First report of platinum-group minerals at Blue Lake, Labrador Trough, Quebec. Can. Mineral., 28, 409–418.

The mean (and range) of five electron-microprobe analyses gave Pd 34.68, Pt 0.45, Ir 0.28, Fe 4.31, Ni 2.80, Pb 1.30, Sn 1.92, Hg 0.14, Bi 13.55, Te 16.38, Sb 22.27, As 1.08, S 1.10, sum (99.12–100.93) wt%, interpreted as ideally Pd(Sb,Te,Bi). The mineral occurs in pyrrhotite as part of a 25-μm inclusion in which there is complex intergrowth with michenerite and altaite. In reflected light, creamy to yellow, nonpleochroic, isotropic.

The mineral occurs in the Blue Lake Cu-Ni massive sulfide (pyrrhotite, chalcopyrite, pentlandite) deposit in a gabbro-peridotite sill northeast of Schefferville, Quebec. The composition is similar to that of UN1976–4 from

Sudbury (L.J. Cabri and J.H.G. Laflamme, *Econ. Geol.*, 71, 1159–1195, 1976).

Discussion. A mineral with the composition $Pd(As_{0.6}Te_{0.4})$ has been reported, without accompanying data, to occur in the Noril'sk ores, USSR (*Am. Mineral.*, 74, p. 1218, 1989). **J.L.J.**

Pd_2Sb, Pd_4Sb

Z. Johan, M. Ohnenstetter, E. Slansky, L.M. Barron, D. Suppel (1989) Platinum mineralization in the Alaskan-type intrusive complexes near Fifield, New South Wales, Australia. Part 1. Platinum-group minerals in clinopyroxenites of the Kelvin Grove prospect, Owendale intrusion. Mineral. Petrology, 40, 289–309.

Electron microprobe analysis (not given) of veinlets about 2 μm wide in clinopyroxene gave a composition corresponding to $(Pd_{1.93}Pt_{0.24})_{\Sigma 2.17}(Sb_{0.90}As_{0.10})$, approximating Pd_2Sb. Analysis of a mineral along a boundary between clinopyroxene crystals gave $(Pd_{4.07}Pt_{0.04})_{\Sigma 4.11}Sb$. Pd_2Sb is known as a synthetic phase, but Pd_4Sb is not. The minerals occur in the Kelvin Grove prospect, Owendale intrusive complex, near Fifield, New South Wales, Australia.

Discussion. $(Pd,Pt,Ni)_2(Sb,Sn)$ has been reported to occur in China (*Am. Mineral.*, 60, p. 739, 1975); also reported, but without supporting data, is $Pd_2(Sb,Sn)$ at Noril'sk, USSR (*Am. Mineral.*, 74, p. 1218, 1989). **J.L.J.**

$PtAs_2S_4$, $Pd_2(Cu,Ag)_2S_3$, and Pd_8Te_3

T.L. Grokhovskaya, V.V. Distler, A.A. Zakharov, S.F. Klyunin, I.P. Laputina (1989) Association of platinum-group minerals in the Lukkulaisvaara layered intrusion, northern Karelia. Doklady Akad. Nauk SSSR, 306(2), 430–434 (in Russian).

The peridotite-gabbro-norite intrusion contains minerals of the platinum-group elements associated with disseminated magmatic sulfides. The $PtAs_2S_4$ and $Pd_2(Cu,Ag)_2S_3$ phases are restricted to chalcopyrite-rich assemblages in microgabbro and norite; a Pd_8Te_3 phase, in contrast, occurs in pegmatoidal pyroxenites in association with a copper-nickel sulfide assemblage that is similar to that observed in other layered intrusions. The minerals occur as multimineralic intergrowths and individual irregular grains, typically 5–10 μm across, included in chalcopyrite, pentlandite, or silicate phases.

$PtAs_2S_4$

Analysis by electron microprobe gave Pt 41.40, Ni 0.19, Te 0.23, Bi 2.71, Sb 0.26, As 28.76, S 24.14, sum 97.69 wt%, corresponding to $PtAs_{1.81}S_{3.55}$. The mineral is associated with chalcopyrite, pentlandite, cobaltite, sperrylite, mertieite, isomertieite, majakite, stillwaterite, kotulskite, merenskyite, hollingworthite, electrum, and $Pd_2(Cu,Ag)_2S_3$. Associated pentlandite and cobalite contain significant Pd (up to 0.17 and 1.10 wt%, respectively).

$Pd_2(Cu,Ag)_2S_3$

Analysis by electron microprobe gave Pd 45.58, Cu 22.73, Ag 9.57, Ni 0.18, S 19.91, sum 97.98 wt%, corresponding to $Pd_2(Cu_{1.67}Ag_{0.41})_{\Sigma 2.08}S_{2.90}$. Gray in reflected light, isotropic. The association is the same as that for $PtAs_2S_4$.

Pd_8Te_3

Analysis by electron microprobe gave Pt 0.62, Pd 61.60, Ag 4.41, Te 32.76, sum 99.39 wt%. The average formula (from 6 analyses) is $(Pd_{7.368}Ag_{0.184}Pt_{0.036})_{\Sigma 7.956}Te_3$ (sic). The mineral occurs in polymineralic inclusions in chalcopyrite along with tulameenite (with up to 7 wt% Pd), moncheite (with up to 0.5 wt% Ir and 0.3 wt% Rh), telargpalite (with up to 9.5 wt% Pb), and kotulskite.

Discussion. The occurrence of Pd_8Te_3 as an unnamed mineral has been reported previously (*Am. Mineral.*, 69, p. 410, 1984). **D.A.V.**

$(Pt,Pd)_2PbSb$, Pd_2CuSb, $RhNiAs$, $Rh_2Ni_3S_6$, Rh_2Te_3

D. Hagen, Th. Weiser, T. Htay (1990) Platinum-group minerals in Quaternary gold placers in the upper Chindwin area of northern Burma. Mineral. Petrology, 42, 265–286.

Electron-microprobe analyses of several phases occurring as inclusions in Pt-Fe and Os-Ir-Ru alloys do not correspond to those of known minerals.

$(Pt,Pd)_2PbSb$

Occurs as light brown, strongly anisotropic platelets up to 30 μm across in Pt-Fe alloys. Four analyses gave Pd 15.09–16.36, Ir 0.63–0.92, Pt 31.28–33.64, Pb 27.91–35.39, Fe to 0.56, Cu to 0.49, Ni 0.44–0.53, Sb 13.76–20.58, total 98.12–100.54 wt%; the average corresponds to $(Pt_{1.05}Pd_{0.96}Ni_{0.05}Ir_{0.03}Fe_{0.03}Cu_{0.02})_{\Sigma 2.14}Pb_{0.98}Sb_{0.90}$.

Pd_2CuSb

Occurs as brownish violet, isotropic, droplet-like inclusions up to 15 μm across in Pt-Fe alloys. Two analyses gave Pd 54.10, 51.48, Pt 4.52, 5.90, Fe 0.31, 0.63, Cu 13.46, 13.88, Sb 29.37, 28.98, sum 101.76, 100.87 wt%, corresponding to $(Pd_{2.05}Pt_{0.09})_{\Sigma 2.14}(Cu_{0.86}Fe_{0.02})_{\Sigma 0.88}Sb_{0.97}$, and $(Pd_{1.97}Pt_{0.12})_{\Sigma 2.09}(Cu_{0.89}Fe_{0.05})_{\Sigma 0.94}Sb_{0.97}$.

$Pd_7Cu_2S_4$

Occurs as a droplet-like grain 10 μm across, in a composite grain with Pt-Fe alloy, as an inclusion in iridosmine. An analysis gave Pd 71.86, Os 0.37, Ir 0.99, Pt 0.61, Cu 12.90, S 12.07, sum 98.80 wt%, corresponding to $(Pd_{6.94}Os_{0.02}Ir_{0.05}Pt_{0.03})_{\Sigma 7.04}Cu_{2.09}S_{3.87}$.

RhNiAs

Occurs in rutheniridosmine as a light brown, isotropic, cubic grain, 10 μm across, associated with pentlandite as a composite inclusion. Analysis gave Rh 40.56, Ru 1.72, Os 0.93, Ir 2.08, Fe 0.37, Ni 21.44, S 1.81, As 29.52, sum 98.43 wt%, corresponding to $(Rh_{0.95}Ru_{0.04}Ir_{0.03}Os_{0.01})_{\Sigma 1.03}$-$(Ni_{0.88}Fe_{0.02})_{\Sigma 0.90}(As_{0.95}S_{0.14})_{\Sigma 1.09}$.

$Rh_2Ni_3S_6$

Occurs in Pt-Fe alloy as a light gray, isotropic, cubic inclusion 15 μm across. Analysis gave Rh 16.22, Ir 20.19, Pt 2.46, Fe 5.08, Cu 3.88, Ni 21.82, S 27.95, sum 97.60 wt%, corresponding to $(Rh_{1.04}Ir_{0.69}Pt_{0.08})_{\Sigma 1.81}(Ni_{2.44}Fe_{0.60}Cu_{0.40})_{\Sigma 3.44}S_{5.73}$.

Rh_2Te_3

Occurs in Pt-Fe alloy as a droplet-like isotropic inclusion 15 μm long. Optically light gray with a light blue tinge. Analysis gave Rh 24.20, Ir 5.67, Pt 2.72, Pb 7.09, Te 56.05, Bi 4.98, sum 100.71 wt%, corresponding to $(Rh_{1.52}Pb_{0.22}Ir_{0.19}Pt_{0.09})_{\Sigma 2.02}(Te_{2.83}Bi_{0.15})_{\Sigma 2.98}$. Similar to $Rh(Te,Bi)_2$ described by Cabri et al. (*Bull. Mineral.,* 104, 508–525, 1981).

The minerals occur as placer grains in alluvium in the Chindwin-Uyu area near Homalin, about 1000 km north of Rangoon, Burma. The platinum-group minerals are assumed to have originated in ophiolites in northern Burma.

Discussion. The phases seem to be unique. The closest in composition to the Rh_2Te_3 phase is sulrhodite, Rh_2S_3. Rh-Ni-Sb, which may be the analogue of the RhNiAs phase, was abstracted in *Am. Mineral.,* 74, 1216–1217, 1989. RhNiAs is also reported in the abstracted paper by Corrivaux and Laflamme (this series). **J.L.J.**

$Pt_2(Ir,Os)Fe_{0.65}$ and Ir minerals

L.P. Nilsson (1990) Platinum-group mineral inclusions in chromitite from the Osthammeren ultramafic tectonite body, south central Norway. Mineral. Petrology, 42, 249–263.

Unnamed platinum-group minerals, for which quantitative electron-microprobe analyses are given, have formulas reported as $Pt_2(Ir,Os)Fe_{0.65}$, IrSbS, (Ir,Rh)SbS, and $(Ir,Pt,Pb)S_2$. The formula of the first mineral was recalculated after deduction of some Fe attributed to the host chromite and resembles that of unnamed Pt_2IrFe (see L.J. Cabri, *CIM Special Vol.* 23, p. 194, 1981). The similarly recalculated analysis of the last mineral corresponds to $(Ir_{0.64}Pt_{0.22}Pb_{0.18})_{\Sigma 1.04}S_{1.95}$.

Discussion. IrSbS and (Ir,Rh)SbS presumably are tolovkite. The formula of the last mineral approximates that of so-called β-iridisite (*Am. Mineral.,* 74, p. 1215, 1989). **J.L.J.**

Pt_2Cu_3, Pt-Cu-Au alloy, $(Cu,Fe)_{1-x}(Pd,Rh,Pt)_{2+x}S_2$

Z. Johan, M. Ohnenstetter, W. Fisher, J. Amossé (1990) Platinum-group minerals from the Durance River alluvium, France. Mineral. Petrology, 42, 287–306.

Pt_2Cu_3

The phase occurs as crystallographically oriented exsolved grains generally <10 μm in longest dimension, in iridium, and as a single isolated grain. One of the two electron-microprobe analyses of the latter gave Pt 56.33, Pd 7.51, Rh 0.32, Cu 33.77, Fe 1.16, sum 99.09 wt%, corresponding to $(Pt_{1.580}Pd_{0.385}Rh_{0.015})_{\Sigma 1.980}(Cu_{2.905}Fe_{0.115})_{\Sigma 3.020}$, ideally Pt_2Cu_3.

Pt-Cu-Au alloy

The average of three analyses of a single, isolated grain gave Au 10.91, Pt 64.32, Pd 1.47, Rh 0.28, Cu 21.02, Fe 0.29, As 0.76, Sb 0.20, sum 99.25 wt%, corresponding to $(Pt_{0.88}Pd_{0.04}Fe_{0.01}As_{0.03}Rh_{0.01})_{\Sigma 0.97}(Cu_{0.88}Au_{0.15})_{\Sigma 1.03}$. It is suggested that the phase may be an ordered, ternary (Pt,Cu,Au) alloy with a distorted CuAu-type structure.

$(Pt,Pd)_{4+x}Cu_2As_{1-x}$

The phase occurs as a droplet-like inclusion in isoferroplatinum; gray in reflected light, reflectance slightly lower than that of isoferroplatinum. The average of three electron-microprobe analyses gave Pt 73.98, Pd 5.19, Rh 0.17, Cu 12.41, Fe 0.28, As 5.69, Sb 0.08, sum 97.80 wt%, corresponding to $(Pt_{3.76}Pd_{0.48}Rh_{0.02})_{\Sigma 4.26}(Cu_{1.93}Fe_{0.05})_{\Sigma 1.98}(As_{0.75}Sb_{0.01})_{\Sigma 0.76}$, generalized as $(Pt,Pd)_{4+x}Cu_2As_{1-x}$ with $x \approx 0.25$. The ideal formula may be $(Pt,Pd)_{17}Cu_8As_3$.

$(Cu,Fe)_{1-x}(Pd,Rh,Pt)_{2+x}S_2$

A grain associated with cuprorhodsite is gray with a brownish shade in reflected light in oil; reflectance slightly higher than that of cuprorhodsite; no anisotropism observed. Analysis gave Rh 11.62, Pt 13.40, Pd 42.40, Fe 2.24, Ni 0.05, Cu 10.19, Au 0.18, S 16.34, sum 96.42 wt%, corresponding to $(Pd_{1.54}Cu_{0.62}Rh_{0.44}Pt_{0.27}Fe_{0.15})_{\Sigma 3.02}S_{1.98}$. The ideal formula may be $(Cu,Fe)_{1-x}(Pd,Rh,Pt)_{2+x}S_2$.

Also reported with shandite in a (Au,Cu,Ag) alloy is a 2-μm inclusion for which the formula $(Ni_{0.94}Pt_{0.10}Pd_{0.04})_{\Sigma 1.08}(Sn_{0.90}Pb_{0.01})_{\Sigma 0.91}$, possibly (Ni,Pt)Sn, is derived. The grains occur with numerous other platinum-group minerals in heavy-mineral concentrates from alluvium in the Durance River near Peyrolles (Bouches-du-Rhône), France. **J.L.J.**

Barium titanosilicate

E.V. Sokolova, Yu.K. Egorov-Tismenko, L.A. Pautov, D.I. Belakovskii (1989) On the structure of the natural barium titanosilicate $BaMn_2TiO[Si_2O_7](OH)_2$—A member of the seidozerite-nacaphite homologous series. Zapiski Vses. Mineralog. Obshch., 118(4), 81–84 (in Russian).

The mineral occurs with a rhodonite-tephroite-spessartine-quartz assemblage in the Inyl'chek Range, southeastern Kirghizia, USSR. The empirical formula is reported to be $(Ba_{0.96}Na_{0.03}Ca_{0.01}Cs_{0.002})_{\Sigma 1.00}(Mn_{1.70}Fe_{0.17}Mg_{0.05}Al_{0.08})_{\Sigma 2.00}(Ti_{0.93}Sn_{0.07}Nb_{0.015})_{\Sigma 1.01}(Si_{1.97}Al_{0.02})_{\Sigma 1.99}O_7O_{2.09} \cdot 0.25H_2O$ (no analytical data or procedure given). Single-crystal X-ray study showed the mineral to be triclinic, space group $P1$ or $P\bar{1}$, $a = 10.764(7)$, $b = 13.858(9)$, $c = 32.99(6)$ Å, $\alpha = 90.2(1)$, $\beta = 94.6(1)$, $\gamma = 89.96(5)°$, $Z = 24$. No powder-diffraction data given. The mineral seems to be the manganese analogue of bafertisite, $BaFe_2TiOSi_2O_7(OH)_2$; *a* and *b* cell parameters are closest to those of bafertisite, but *c* is nearly three times as large. The mineral structure consists of alternating layers and interlayer units that are structurally similar to those of seidozerite and nacaphite, respectively. Atomic coordinates are tabulated.**D.A.V.**

Zn-Te-Pb-Mn-bearing phyllosilicates

A.A. Kim, L.V. Nikishova, A.V. Sivtsov, V.F. Makhotko (1988) Zinc-tellurium-lead-manganese-bearing phyllosilicates from the Kuranakh gold deposit. Mineralog. Zhurnal, 10(5), 11–19 (in Russian).

Clay mineral aggregates, 1–2 mm across, occur with mustard gold and calcite in the oxidation zone of the Kuranakh gold deposit, central Aldan. The rosy red aggregates contain inclusions, up to 0.3 mm across, of rounded pitch-black clay aggregates. Associated minerals include tiemannite, orpiment, fluorite, descloizite, yafsoanite, and other tellurates. The rosy and black aggregates appear identical in grain mounts: material is flaky, colorless, transparent with no pleochroism, biaxial negative, α = 1.580–1.586, γ = 1.596–1.611, increasing to 1.630 as it resides in the immersion oil. H = 1–1½, D_{meas} = 2.67 g/cm³. Aggregates do not dissolve in acid. Electron-microprobe analysis of the clay aggregate (water and Fe^{3+}/Fe^{2+} determined separately) gave SiO_2 32.80, TeO_2 13.29, Fe_2O_3 2.13, FeO 1.06, MgO 10.38, ZnO 18.28, As_2O_5 0.15, CaO 1.05, PbO 10.95, H_2O^+ 5.95, H_2O^- 4.96, sum 101.00 wt%. This analysis shows unusually high Te, Pb, and Zn for clay minerals. Multiple analyses show that Mg, Zn, and Ca vary little, and Pb and Te vary considerably (2.8–27 wt% and 1.0–14 wt%, respectively) within individual aggregates.

DTA of aggregates yields a pattern similar to that of saponite and hectorite but with the second endothermic peak shifted to higher temperature. Powder X-ray diffraction reveals basal reflections of 14.0 and 2.36 Å; the 14-Å peak shifts to 16.9 Å after glycolation and collapses to 12.8 Å after heating to 500 °C. Electron microdiffraction reveals a 060 spacing of 1.53 Å, corresponding to a trioctahedral-type smectite.

Detailed electron microdiffraction and microprobe chemical analyses suggest that the aggregates contain at least three separate phyllosilicate phases. Phase I is a Zn-bearing, Pb- and Te-free trioctahedral smectite, intermediate between saponite and sauconite, with d_{001} = 13.0, d_{060} = 1.53, a = 5.24, b = 9.18 Å. Phase II is proposed to be a Pb- and Te-rich phyllosilicate, and phase III is proposed to be a Mn- and Te-rich silicate. Electron-microprobe analyses of spots yielding the highest Pb, Te, etc., are given as possibly representative of phases I, II, and III. Anhydrous totals vary from 63–82 wt%. Crystallochemical formulas, which are proposed as possible formulas, are: phase I, $(Ca_{0.1}Mg_{0.1})_{\Sigma 0.2}(Mg_{1.63}Zn_{1.37})_{\Sigma 3}(Si_{3.6}Al_{0.2}Fe_{0.2})_{\Sigma 4}O_{10.8}(OH)_{1.2}\cdot nH_2O$; phase II, $(Pb_{0.4}Te_{0.1}Ca_{0.1})_{\Sigma 0.6}(Mg_{1.75}Zn_{1.25})_{\Sigma 3}(Si_{3.4}Fe_{0.3}Te_{0.3})_{\Sigma 4}O_{10.85}(OH)_{1.15}\cdot nH_2O$; phase III, $(Ca_{0.1}Te_{0.02}Mn_{0.01})_{\Sigma 0.13}(Zn_{1.58}Mg_{1.42})_{\Sigma 3}(Si_{2.6}Mn_{0.9}Al_{0.4}Fe_{0.2})_{\Sigma 4.1}O_{10.75}(OH)_{1.25}\cdot nH_2O$.

Discussion. The chemical analyses and electron photomicrographs are insufficient to determine whether phases II and III are actually new smectites or whether they represent phase I contaminated by submicroscopic tellurate inclusions. The extreme variability of Pb and Te within the clay aggregates would seem to favor the latter interpretation. **D.A.V.**

New Data

Dugganite

A.A. Kim, N.V. Zayakina, Yu.G. Lavrent'ev, V.F. Makhotko (1988) Vanadian silician variety of dugganite—the first find in the USSR. Mineralog. Zhurnal, 10(6), 85–89 (in Russian).

Analysis by electron microprobe (average of 8) gave PbO 51.94, ZnO 18.33, TeO_3 14.15, As_2O_5 7.10, V_2O_5 4.30, SiO_2 2.37, Sb_2O_5 0.25, P_2O_5 0.02, H_2O 0.25 (determined from analyzed O, which exceeded that required to balance the cations and was thus assigned to H_2O), sum 98.71 wt%. The range of analyses is encompassed in the formula $Pb_3Zn_3Te(As,V)_{2-x}Si_xO_{14-x}(OH)_x$, where x = 0.17–0.68, or more generally $Pb_3Zn_3Te(As,V,Si)_2(O,OH)_{14}$ (based on Pb + Zn = 6. The mineral dissolves in HCl with precipitation of $PbCl_2$. Crystals up to 0.5 mm are prismatic, with {100}, {001}, and {010} predominant. Good {100} cleavage; pale green, transparent, and colorless in thin section; interference colors gray-blue to brown, similar to those of zoisite; length slow, α = 1.986(5), γ = 1.997(5), $2V$ = −20°, $Z = c$, H_{10} = 390 kg/mm². Single-crystal X-ray study showed the mineral to be orthorhombic, space group *Cmmm, C*222, *Cm*2*m*, or *Cmm*2. Powder-diffraction study gave a = 8.57(3), b = 14.84(5), c = 5.21(3) Å, D_{calc} = 6.48 g/cm³, Z = 2. It is noted that normal dugganite can also be satisfactorily indexed on an orthorhombic unit cell. The strongest lines for the V-Si variety (30 given) are 3.30(100,131,201), 3.01(90,221,041), 1.904(80,242,152,312), and 1.609(70,352,422,177).

The mineral occurs as a supergene oxidation product in calcite veins of the gold-bearing metasomatic Kuranakh deposit (Central Aldan, USSR), associated with gold and a number of relict selenides, tellurides, and sulfides of Hg, Ag, Pb, and As (e.g., tiemannite, naumannite, clausthalite, altaite, cinnabar, orpiment), and with other Zn, Pb, and Mn tellurates and vanadates (e.g., yafsoanite, kuranakhite, descloizite). Other analogues of dugganite that contain V + Si ≫ As, or significant substitution of As by P, are reported but were not studied in detail.

Discussion. Differs from type dugganite, which is hexagonal (*Am. Mineral.* 63, 1016–1019, 1978). **D.A.V.**