

## NEW MINERAL NAMES\*

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### Bernalite\*

W.D. Birch, A. Pring, A. Reller, H. Schmalte (1992) Bernalite: A new ferric hydroxide with perovskite structure. *Naturwiss.*, 79, 509–511.

Electron microprobe and CHN analyses (not listed) gave the formula  $(\text{Fe}_{0.92}\text{Si}_{0.06}\text{Zn}_{0.01}\text{Pb}_{0.01})(\text{OH})_{2.96}(\text{CO}_3)_{0.03} \cdot 0.08\text{H}_2\text{O}$ , simplified as  $\text{Fe}(\text{OH})_3 \cdot n\text{H}_2\text{O}$ , in which  $n$  ranges from 0.0 to <0.25. Occurs as dark bottle green octahedra, up to 3 mm on edge, that are seen in thin section to be polysynthetically twinned fibrous grains approximately 30  $\mu\text{m}$  long;  $D_{\text{meas}} = 3.32(2)$ ,  $D_{\text{calc}} = 3.23 \text{ g/cm}^3$ , with  $Z = 8$ . Single-crystal X-ray structure study ( $R = 0.106$ ) indicated pseudocubic orthorhombic symmetry, space group  $Immm$ ,  $a = 7.544(2)$ ,  $b = 7.560(4)$ ,  $c = 7.558(2)$  Å. Decomposes at 180 °C, releasing  $\text{H}_2\text{O}$ . The structure is not related to those of other iron hydroxides or gibbsite but belongs to the stottite or schoenfliesite groups.

The mineral occurs with goethite and coronadite in two specimens collected some seventy years ago from the oxidized zone of the Proprietary mine, Broken Hill, New South Wales, Australia. The new name is for J. D. Bernal (1901–1971), British crystallographer. Full descriptions of the structure and other properties will be published later. J.L.J.

### Buckhornite\*

C.A. Francis, A.J. Criddle, C.J. Stanley, D.E. Lange, S. Shieh, J.G. Francis (1992) Buckhornite,  $\text{AuPb}_2\text{BiTe}_2\text{S}_3$ , a new mineral species from Boulder County, Colorado, and new data for aikinite, tetradymite and calaverite. *Can. Mineral.*, 30, 1039–1047.

Electron microprobe analyses gave Cu 0.1, Au 17.0, Pb 34.5, Bi 18.4, Te 22.3, S 7.8, sum 100.1 wt%, corresponding to  $\text{Au}_{1.02}\text{Cu}_{0.02}\text{Pb}_{1.97}\text{Bi}_{1.04}\text{Te}_{2.06}\text{S}_{2.89}$ , ideally  $\text{AuPb}_2\text{BiTe}_2\text{S}_3$ . Occurs as splendid, flexible, sectile, black blades up to  $1.5 \times 0.2 \times 0.01$  mm; gray streak,  $VHN_{10} = 54$ , perfect cleavage along elongation,  $D_{\text{calc}} = 8.34 \text{ g/cm}^3$  for the idealized formula. Optically opaque, birefractant, brownish gray to pale bluish gray pleochroism, distinctly anisotropic from blue to mauve. Relative to CIE illuminant C, color values for  $R_1$  and  $R_2$  are, respectively,  $x = 0.311, 0.300$ ,  $y = 0.318, 0.308$ ,  $Y\% = 40.95, 47.4$ ,  $\lambda_d 571$ ,

480,  $P_c\% = 0.7, 4.4$ . X-ray single-crystal study indicated orthorhombic symmetry, space group  $Pmmm$  or  $P222$ ,  $a = 4.092(2)$ ,  $b = 12.245(4)$ ,  $c = 9.322(4)$  Å. Strongest lines of the powder pattern are 3.739(vs,101,131), 3.108(vs,003), 2.763(vvs,131), 2.456(vs,132,140), 2.390(vvs,141), and 2.044(s,200,050).

The mineral occurs as free-standing crystals and clusters in vugs in pyrite in specimens from the former Pb-Ag Buckhorn mine, Boulder County, Colorado. Type material is at the Harvard Mineralogical Museum, The Natural History Museum (London), and the U.S. National Museum, Washington. Unnamed minerals reported previously to occur in Armenia (*Am. Mineral.* 76, p. 1437, 1991) and in the former Czechoslovakia (*Am. Mineral.* 73, p. 932; 1988) may be buckhornite. J.L.J.

### Chelyabinskite

B.V. Chesnokov, L.F. Bazhenova, E.P. Shcherbakova, T.A. Michal, T.N. Deriabina (1988) New minerals from the burned dumps of the Chelyabinsk coal basin. In *Mineralogy, technogenesis, and mineral-resource complexes of the Urals*, 5–31. Akad. Nauk SSSR–Uralskoe Otdel. (in Russian).

Chemical analysis gave  $\text{SiO}_2$  10.00,  $\text{Al}_2\text{O}_3$  1.17,  $\text{Fe}_2\text{O}_3$  1.14,  $\text{MnO}$  <0.05,  $\text{MgO}$  1.16,  $\text{CaO}$  26.06,  $\text{SO}_3$  19.73,  $\text{CO}_2$  4.30,  $\text{H}_2\text{O}$  36.58, sum 100.14 wt%, corresponding to  $[(\text{Ca}_{2.79}\text{Mg}_{0.17})_{\Sigma 2.96}\text{Si}_{1.00}(\text{OH})_{6.00} \cdot 9.2\text{H}_2\text{O}][(\text{SO}_4)_{1.48}(\text{CO}_3)_{0.59}]_{\Sigma 2.07}$  by analogy with the formula of thaumasite. Loose accumulations or incrustations consisting of white spherules of fine fibrous or earthy structure occur in burned dumps of the Chelyabinsk coal basin, Russia. Luster silky to dull,  $H = \sim 3$ . Closed-tube test gives large amounts of steam; boils intensely in HCl, leaving a silicious residuum. Bluish white luminescence in ultraviolet light. Optically biaxial, straight extinction, negative elongation,  $\alpha = 1.475$ ,  $\beta = 1.495$ ,  $\gamma = 1.508$ ,  $2V_{\text{calc}} = 77^\circ$ . Orthorhombic,  $a = 19.01(2)$ ,  $b = 20.93(1)$ ,  $c = 22.45(1)$  Å,  $Z = 18$ ,  $D_{\text{calc}} = 1.938$ ;  $D_{\text{meas}} = 1.908\text{--}1.912 \text{ g/cm}^3$ . The X-ray powder pattern is similar to that of thaumasite; strongest lines are 9.86(100,102), 9.52(100,200), 3.79(80,225), 2.724(70,462), and 2.502(80,651). The infrared pattern and DTA curve are similar to those of thaumasite, but an additional exotherm at 740 °C is present. The name is for the place of occurrence.

**Discussion.** The new name was submitted to the CNMMN in 1986 and was not approved. J.P.

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

**Kopeiskite**

B.V. Chesnokov, L.F. Bazhenova, E.P. Shcherbakova, T.A. Michal, T.N. Deriabina (1988) New minerals from the burned dumps of the Chelyabinsk coal basin. In *Mineralogy, technogenesis and mineral-resource complexes of the Urals*. Akad. Nauk SSSR-Uralskoe Otdel., 5–31 (in Russian).

Chemical analysis (no method stated) gave Fe 18.45, NH<sub>4</sub> 12.42, Cl 57.46, H<sub>2</sub>O 7.95, Al 0.71, Ca 0.39, Mg 0.20, Mn 0.03, OH (TGA) 0.43, sum 100.18 wt%, corresponding to (NH<sub>4</sub>)<sub>2.00</sub>(Fe,Al,Ca,Mg)<sub>1.08</sub>(Cl,OH)<sub>5.00</sub> · 1.05H<sub>2</sub>O. Readily soluble in H<sub>2</sub>O, giving a yellow solute with positive Cl reaction; reacts with NaOH, producing NH<sub>3</sub>. Melts into a translucent reddish brown bead with a greasy luster; under further heating melts into a black, magnetic substance. In closed tube yields H<sub>2</sub>O, melts into a reddish brown liquid, and sublimes. Endotherms on the DTA curve (related to H<sub>2</sub>O loss, weight percent in parentheses): ~90 (2.14), 185 (7.95); 225 (0.43), 237 (melting); exotherms appear at 325 and 435 °C, and above 1000 °C finely crystalline hematite is produced. Occurs as orthorhombic crystals <1 mm, with dominant forms {210}, {100}, {011}. Bright orange-red color, vitreous luster,  $H = 2.5$ , brittle, good {210} cleavage,  $D_{\text{meas}} = 1.99(1)$ ,  $D_{\text{calc}} = 1.998 \text{ g/cm}^3$ , with  $Z = 4$ . Optically biaxial positive,  $\alpha = 1.737$ ,  $\beta = 1.754$ ,  $\gamma = 1.790$ ,  $2V_{\text{calc}} = 68^\circ$ , strong dispersion  $r > v$ , weak pleochroism:  $X$  and  $Z$  brownish yellow with green tint,  $Y$  reddish brown,  $Y > X$  and  $Z$ ;  $X = a$ ,  $Y = c$ ,  $Z = b$ . No luminescence in ultraviolet light. X-ray study showed the mineral to be orthorhombic, space group  $Pnmm$  or  $Pnm2_1$ ,  $a = 13.68(2)$ ,  $b = 9.84(2)$ ,  $c = 7.01(2) \text{ \AA}$ . The powder pattern is analogous to that of synthetic (NH<sub>4</sub>)<sub>2</sub>FeCl<sub>5</sub> · H<sub>2</sub>O and has strongest lines of 5.597(100,210), 2.808(100,420), 1.776(50,302), and 2.471(80,040). The mineral occurs in waste dumps in the Chelyabinsk coal basin as a typical component of chloride accumulations. The name is for the type locality, the town of Kopeisk.

**Discussion.** The mineral, which was recognized to correspond to kremersite, the NH<sub>4</sub>-dominant member of the series KFeCl<sub>5</sub> · H<sub>2</sub>O–NH<sub>4</sub>FeCl<sub>5</sub> · H<sub>2</sub>O, was rejected by the CNMMN. **J.P.**

**Korkinoite**

B.V. Chesnokov, L.F. Bazhenova, E.P. Shcherbakova, T.A. Michal, T.N. Deriabina (1988) New minerals from the burned dumps of the Chelyabinsk coal basin. In *Mineralogy, technogenesis, and mineral-resource complexes of the Urals*. Akad. Nauk SSSR-Uralskoe Otdel., 5–31 (in Russian).

Occurs as radial aggregates of flattened prismatic crystals 2–3 mm long, striated parallel to the elongation; less commonly with orthorhombic pyramidal faces. Transparent, colorless, vitreous luster, brittle,  $H = \sim 3$ , readily boils in HCl; in a closed tube, yields H<sub>2</sub>O. Positive reactions for Ca and SO<sub>4</sub>. Optically biaxial positive,  $\alpha =$

1.518,  $\beta = 1.528$ ,  $\gamma = 1.556$ ,  $X$  parallel to {010}. Orthorhombic symmetry, space group  $Pmmm$ ,  $a = 40.15$ ,  $b = 11.24$ ,  $c = 10.99 \text{ \AA}$ . Strongest lines of the Debye-Scherrer pattern are 7.88(100,011), 4.33(60,512), 3.90(60,222), 3.118(70,731), and 2.805(60,732). Similar to thaumasite. Occurs in burned dumps of the Chelyabinsk coal basin, Russia.

**Discussion.** An unapproved name; chemical analysis is necessary for evaluation of the species. **J.P.**

**Peprossite-(Ce)\***

G. Della Ventura, G.C. Parodi, A. Mottana, M. Chausidon (1993) Peprossite-(Ce), a new mineral from Campagnano (Italy): The first anhydrous rare-earth-element borate. *Eur. Jour. Mineral.*, 5, 53–58.

The unnamed, anhydrous borate of ideal formula (Ce,La)Al<sub>2</sub>B<sub>3</sub>O<sub>9</sub> for which data were abstracted in *Am. Mineral.* 77, 672–673 (1992) is named peprossite-(Ce) in honor of Giuseppe (“Pep”) Rossi, Italian mineralogist and crystallographer (1938–1990). Occurs as light yellow flakes of hexagonal outline, transparent to translucent, vitreous luster,  $H = 2$ , perfect {0001} and distinct {11.0} cleavages; platy and typically in books, occasionally as rosettes, with clusters to a maximum of 2 mm;  $D_{\text{meas}} = 3.45(5)$ ,  $D_{\text{calc}} = 3.476 \text{ g/cm}^3$ , with  $Z = 1$ . Optically uniaxial positive,  $\omega = 1.703(2)$ ,  $\epsilon = 1.711(5)$ , colorless. Single-crystal X-ray structure study ( $R = 0.015$ ) indicated hexagonal symmetry, space group  $P62m$ ,  $a = 4.610(1)$ ,  $c = 9.358(7) \text{ \AA}$ , as refined from a 114-mm Gandolfi pattern (Cu radiation) with strongest lines of 3.67(100,101), 3.04(100,102), 2.458(75,103), 2.308(50,110), 2.020-(50,104), 1.953(50,201), 1.855(50,113), and 1.835-(50,202).

The mineral occurs in vugs among sanidine crystals in a sanidinite ejectum within the pyroclastics of the Sacrofano volcanic center, Campagnano, Latium, Italy. Type specimens are at the Museo di Mineralogia, University of Rome, Italy, and the Museum National d’Histoire Naturelle, Paris, France. **J.L.J.**

**Redikortsevite**

B.V. Chesnokov, L.F. Bazhenova, E.P. Shcherbakova, T.A. Michal, T.N. Deriabina (1988) New minerals from the burned dumps of the Chelyabinsk coal basin. In *Mineralogy, technogenesis, and mineral-resource complexes of the Urals*. Akad. Nauk SSSR-Uralskoe Otdel., 5–31 (in Russian).

Chemical analysis (method unstated) gave (NH<sub>4</sub>)<sub>2</sub>O 8.44, MgO 12.80, Cl 39.21, Fe<sub>2</sub>O<sub>3</sub> 2.54, Al<sub>2</sub>O<sub>3</sub> 1.51, CaO 0.60, MnO 0.11, K<sub>2</sub>O + Na<sub>2</sub>O < 0.10 wt%, corresponding to (ideally) NH<sub>4</sub>MgCl<sub>3</sub> · 6H<sub>2</sub>O. All Fe<sup>3+</sup> is assumed to be due to admixed kopeiskite (which see). DTA gave endotherms at 315, 395, and 660 °C, marking losses of 24.3 (H<sub>2</sub>O), 17.85 (H<sub>2</sub>O), and 19.79 wt% (NH<sub>4</sub>Cl), respectively. Readily soluble in H<sub>2</sub>O, positive Cl reaction. Reacts

with NaOH, yielding  $\text{NH}_3$ . Closed-tube heating yields  $\text{H}_2\text{O}$  and  $\text{NH}_4\text{Cl}$ . Heating produces a light creamy residue of loose periclase. Flattened, prismatic crystals are light yellow to colorless,  $H = \sim 2.5$ , brittle, no cleavage, conchoidal fracture,  $D_{\text{meas}} = 1.43(1) \text{ g/cm}^3$ . Optically anisotropic,  $\alpha = 1.467$ ,  $\gamma = 1.480$ . Orthorhombic, the X-ray pattern corresponding to that of synthetic  $\text{NH}_4\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ . Strongest lines are 3.85(50,220), 3.35(100,040), 2.99(50,222), and 2.36(50,400). Occurs in liquid chloride masses together with kopeiskite, in dumps of mine 50 of the Chelyabinsk coal basin (Urals, Russia). The name is for I. I. Redikortsev, the discoverer of the Chelyabinsk coal basin.

**Discussion.** An unapproved name that has not been submitted to the CNMMN. **J.P.**

### Sulfalumite

B.V. Chesnokov, L.F. Bazhenova, E.P. Shcherbakova, T.A. Michal, T.N. Deriabina (1988) New minerals from the burned dumps of the Chelyabinsk coal basin. In *Mineralogy, technogenesis, and mineral-resource complexes of the Urals*. Akad. Nauk SSSR-Uralskoe Otdel., 5–31 (in Russian).

Chemical analysis gave  $\text{SO}_3$  63.70,  $\text{Al}_2\text{O}_3$  16.00,  $\text{Fe}_2\text{O}_3$  8.32,  $\text{TiO}_2$  0.71,  $\text{MgO}$  2.98,  $\text{CaO}$  2.76,  $\text{MnO}$  0.16,  $\text{K}_2\text{O}$  1.71,  $\text{Na}_2\text{O}$  0.20,  $\text{H}_2\text{O}$  (weight loss up to 400 °C) 3.51, sum 100.05 wt%, corresponding to  $(\text{Al,Fe}^{3+},\text{Ti})_{1.98}(\text{SO}_4)_{3.00}$ . Ca, Mg, Mn, and alkalis are due to admixture of anhydrite and langbeinite, documented optically and by X-ray study. Readily hydrates in air. Under a flame, does not melt, and becomes light red and magnetic. Slowly soluble in  $\text{H}_2\text{O}$ . The X-ray pattern corresponds to that of synthetic  $\text{Al}_2(\text{SO}_4)_3$ ,  $a = 8.06(1)$ ,  $c = 21.53(1) \text{ \AA}$ ,  $Z = 6$ ,  $D_{\text{calc}} = 2.932 \text{ g/cm}^3$ . Strongest lines of the powder pattern are 5.83(40,012), 4.23(40,104), and 3.50(100,113)  $\text{ \AA}$ . The DTA curve has a strong endotherm at 820 °C. Optically anisotropic, refractive index 1.53–1.54. White, chalklike, commonly foamlake accumulations. The mineral is the main constituent of sulfate-rich covers at the hottest (few hundreds of degrees Celsius) fumarole-type deposits that occur in the burned dumps of the Chelyabinsk coal basin, Russia.

**Discussion.** The mineral corresponds to millosevichite  $(\text{Al,Fe}^{3+})_2(\text{SO}_4)_3$ . **J.P.**

### Swaknoite\*

J.E.J. Martini (1992) Swaknoite  $[\text{Ca}(\text{NH}_4)_2 \cdot (\text{HPO}_4)_2 \cdot \text{H}_2\text{O}]$ , orthorhombic; A new mineral from Arnhem cave, Namibia. *Bull. South African Speleological Assoc.*, 32, 72–74 (1991).

Electron microprobe and CHN analyses gave  $(\text{NH}_4)_2\text{O}$  16.06,  $\text{CaO}$  21.46,  $\text{P}_2\text{O}_5$  48.93,  $\text{H}_2\text{O}$  12.78, sum 99.23 wt%, corresponding to  $\text{Ca}_{1.10}(\text{NH}_4)_{1.78}(\text{HPO}_4)_{1.99} \cdot 1.05\text{H}_2\text{O}$ , ideally  $\text{Ca}(\text{NH}_4)_2(\text{HPO}_4)_2 \cdot \text{H}_2\text{O}$ . Occurs as needles, up to 1 mm long and up to 10  $\mu\text{m}$  wide, commonly grouped as rosettes. Crystals are elongate [001] and show {110},

{100}, {111}, and possibly {001}. White color, vitreous luster, soft and brittle, soluble in  $\text{H}_2\text{O}$ ,  $D_{\text{meas}} = 1.91$ ,  $D_{\text{calc}} = 1.89 \text{ g/cm}^3$ , with  $Z = 4$ . Optically biaxial negative,  $\alpha = 1.506$ ,  $\beta = 1.510$ ,  $\gamma = 1.512$ ,  $2V_{\text{meas}} = 65(10)^\circ$ ,  $2V_{\text{calc}} = 70^\circ$ , dispersion not detected, orientation  $X = b$ ,  $Y = a$ ,  $Z = c$ . An X-ray rotation film of synthesized needles and indexing of the powder pattern gave an orthorhombic cell with  $a = 20.959$ ;  $b = 7.403$ ,  $c = 6.478 \text{ \AA}$ . Strongest lines of the X-ray diffractogram (Co radiation) are 10.5(57,200), 6.99(100,110), 4.739(36,111), 3.705(89,020), 3.651(39,510), and 3.177(55,511).

The mineral, which is a polymorph of mundrabillaite, occurs as a white coating with mundrabillaite, dittmarite, and arcanite on the dolomite walls of Arnhem cave, 150 km east of Windhoek, Namibia. The  $\text{NH}_3$  and  $\text{HPO}_4$  were derived from the decay of bat guano. The new name is an acronym for the Suid Wes Africa Karst Navorsing Organisasie (SWAKNO), a speleological association whose members noted the presence of a wide variety of minerals at Arnhem cave. Type material is in the State Museum, Windhoek, Namibia, and in the Transvaal Museum, Pretoria, South Africa. **J.L.J.**

### $\text{Au}_{94-88}\text{Hg}_{6-12}$

G.A. Desborough, E.E. Foord (1992) A monoclinic, pseudo-orthorhombic Au-Hg mineral of potential economic significance in Pleistocene Snake River alluvial deposits of southeastern Idaho. *Can. Mineral.*, 30, 1033–1038.

Forty-three electron microprobe analyses of 11 grains gave Au 91.84–90.54, Hg 6.04–11.55, sum 88.09–93.85 wt%. Ag is absent, and the low totals are attributed to (visible) microporosity; normalized compositions are Au 88.09–93.85, Hg 6.15–11.91 at%. Occurs as small grains typically < 5  $\mu\text{m}$  in maximum dimension, some showing octahedral forms; less common as monoclinic, prismatic stubby forms and acicular grains up to  $10 \times 150 \mu\text{m}$ . The grains are multidomain rather than single. Color similar but slightly brassier than that of Au. Indexing of the X-ray powder pattern gave monoclinic symmetry,  $a = 4.729(2)$ ,  $b = 5.243(8)$ ,  $c = 4.546(2) \text{ \AA}$ ,  $\beta = 90.90(6)^\circ$ ; the complete pattern is as follows: 2.622(m,020), 2.368(vs,200), 2.277(vw,002), 2.059(m,broad,102), 1.597(vw,122), 1.445(w,103), 1.436(w,103), 1.237(m,213), 1.182(m,400), 0.8661(m,broad,512,343), 0.8393(vs,343). After heating to 370 °C, the X-ray pattern was unchanged, but on heating to 500 °C the pattern was that of pure Au.

The mineral occurs in Pleistocene alluvial deposits along the Snake River near Blackfoot, Idaho. It is thought that the mineral may be a natural stable phase that formed by inversion from a crystalline natural metastable phase. **J.L.J.**

### $\text{Pt}_3\text{Cu}$ , unnamed PGM, $\text{IrO}_2$

O. Legendre, T. Augé (1992) Alluvial platinum-group minerals from the Manampotsy area, east Madagascar. *Australian Jour. Earth Sci.*, 39, 389–404.

T. Augé, O. Legendre (1992) Pt-Fe nuggets from alluvial deposits in eastern Madagascar. *Can. Mineral.*, 30, 983–1004.

### Pt<sub>3</sub>Cu

Pt-Fe nuggets from alluvial deposits in eastern Madagascar range from 0.1 to 1 mm. One nugget consists of cuprian Pt<sub>3</sub>Fe and Pt<sub>3</sub>Cu that are interpreted to have unmixed from an original Pt<sub>6</sub>CuFe phase. Electron microprobe analysis of the Pt<sub>3</sub>Cu gave Pt 79.10, Rh 0.42, Ru 0.38, Pd 5.02, Ir 0.22, Au 0.48, Fe 1.60, Cu 11.39, Ni 0.03, As 0.23, S 0.01, sum 98.88 wt%, corresponding approximately to Pt<sub>60</sub>Pd<sub>7</sub>Cu<sub>27</sub>Fe<sub>4</sub>, ideally (Pt,Pd)<sub>3</sub>Cu.

The following minerals occur in the Pt nuggets as round polymineralic inclusions or as euhedral composite assemblages. The minerals are up to a few micrometers in size. Seven electron microprobe analyses are tabulated and are interpreted to correspond to the following seven compositions: (Pd,Pt)<sub>3</sub>(Te,As), Pd<sub>4</sub>S, (Pd,Pt)<sub>2</sub>S, (Pd,Pt)<sub>3</sub>-(Cu,Ni)S<sub>2</sub>, (Pd,Pt)<sub>2</sub>(Rh,Ir)(Cu,Ni)S<sub>4</sub>, (Pd,Pt,Au)<sub>2</sub>Cu, (Pt,Pd,Rh)<sub>3</sub>S<sub>2</sub>. The first is interpreted to be vincentite in which the absence of Sb is compensated by a higher Te content.

### IrO<sub>2</sub>

One nugget contains prismatic crystals up to 150 × 40 μm. Electron microprobe analysis confirmed the presence of abundant O and gave (all elements calculated as oxides) IrO<sub>2</sub> 80.80, 72.99, RuO<sub>2</sub> 2.88, 4.04, PtO<sub>2</sub> 17.18, 15.60, PdO —, 0.28, RhO<sub>2</sub> 0.52, 0.28, FeO 1.24, 4.95, Cu<sub>2</sub>O 0.88, 0.75, SO<sub>2</sub> —, 0.16, AsO<sub>2</sub> 0.13, —, sum 103.63, 99.04 wt%, leading to the proposed formula IrO<sub>2</sub>. It is suggested that the mineral is primary.

**Discussion.** The authors suggest that the (Pd,Pt)<sub>3</sub>(Te,As) phase is similar to vincentite, the formula of which is uncertain and is possibly (Pd,Pt)<sub>3</sub>(As,Sb,Te). Pd<sub>3</sub>(Te,As) has been reported previously (*Am. Mineral.* 76, p. 1733, 1991). Pd<sub>4</sub>S is known as a synthetic phase. (Pd,Pt)(Rh,Ir)(Cu,Ni)S<sub>4</sub> may be the Pd analogue of Pt(Rh,Ir)CuS<sub>4</sub> abstracted in *Am. Mineral.* 67, p. 1080, 1982. Complete solid solution between PdCu and PtCu at 700 °C has been experimentally demonstrated (*Doklady Akad. Nauk* 327(1), 131–134, 1992). J.L.J.

### Pd<sub>2</sub>(Sb,As)

A.E. Izokh, O.N. Mayorova, Yu.G. Lavrentiev (1992) Minerals of the platinum metals in the Nomgon troctolite-anorthosite-gabbro intrusive massif (Mongolia). *Russian Geol. Geophys.*, 33(1), 87–92.

Leucocratic olivine gabbro with interstitial disseminated chalcopyrite and bornite contains sperrylite, mertieite-II, and several other PGM. Two electron microprobe analyses are given for phase Pd<sub>2</sub>(Sb,As), which is intergrown with sperrylite, isomertieite, majakite, mertieite-II, stibiopalladinite, electrum, and bornite.

**Discussion.** Pd<sub>2</sub>(Sb,Sn) has been reported from several localities (*Am. Mineral.* 76, p. 1438, 1991); and Pd<sub>2</sub>(Sb,As) has been described as occurring in the Coldwell Complex, Ontario (*Am. Mineral.* 77, p. 1307, 1992). J.L.J.

### Pd<sub>4</sub>Cu<sub>2</sub>Sn<sub>3</sub>, Pt<sub>3</sub>Sb, RhSbS, RhNiAs, PtBi

N.S. Rudashevsky, S.N. Avdontsev, M.B. Dneprovskaya (1992) Evolution of PGE mineralization in hortonolitic dunites of the Mooihoek and Onverwacht pipes, Bushveld Complex. *Mineral. Petrology*, 47, 37–54.

Electron microprobe analysis of a mineral in a platinum-group-element (PGE) aggregate consisting of possible tetraferroplatinum, orcelite, and unnamed RhNiAs, which occur in titanian magnetite, gave Rh 37.9, Ir (presumably a misprint for Ru) 3.0, Ni 23.6, Fe 3.0, Co 1.4, As 27.1, S 2.2, sum 99.8 wt%, stated as corresponding to (Rh<sub>0.83</sub>Ru<sub>0.07</sub>)<sub>20.90</sub>(Ni<sub>0.90</sub>Fe<sub>0.18</sub>Co<sub>0.06</sub>)<sub>21.14</sub>(As<sub>0.81</sub>Sb<sub>0.15</sub>)<sub>20.96</sub>.

An irregular grain of tetraferroplatinum (?) which contains inclusions of 1–6 μm of cabriite, cuprian rustenbergite, and unnamed (Pd,Pt)<sub>4</sub>(Cu,Fe)<sub>2</sub>(Sn,Sb)<sub>3</sub> for which microprobe analysis gave Pt 21.0, Pd 31.7, Cu 11.5, Fe 0.9, Sn 33.3, Sb 1.6, sum 100.0 wt%, corresponding to (Pd<sub>2.99</sub>Pt<sub>1.08</sub>)<sub>24.07</sub>(Cu<sub>1.82</sub>Fe<sub>0.16</sub>)<sub>21.98</sub>(Sn<sub>2.82</sub>Sb<sub>1.03</sub>)<sub>22.95</sub>.

Inclusions (1–3 μm) of hollingworthite, platarsite, sperrylite, and unnamed (Pt,Ir,Fe)<sub>3</sub>Sb occur in tetraferroplatinum(?). Analysis of the unnamed mineral gave Pt 70.3, Ru (presumably a misprint for Ir) 10.2, Fe 1.5, Cu 0.6, Sb 17.4, sum 100.0 wt%, corresponding to (Pt<sub>2.43</sub>Ir<sub>0.36</sub>Fe<sub>0.18</sub>Cu<sub>0.07</sub>)<sub>23.04</sub>Sb<sub>0.96</sub>.

Inclusion (1–3 μm) of hollingworthite, sobolovskite(?), and unnamed (Rh,Pt)SbS, (Rh,Fe)(Sb,Bi)S, and (Pt,Fe)(Bi,Sb) occur in tetraferroplatinum(?). Microprobe analyses of the first two gave, respectively, Rh 29.8; 32.6, Pt 7.6, 1.1, Ru (presumably a misprint for Ir) 6.5, 1.8, Fe 1.7, 2.2, Co 0.03, —, Sb 40.2, 27.0, As 1.0, 0.6, S 10.7, 9.9; Bi 2.7, 22.8, Sn 1.0, 0.8, sum 101.5, 98.8 wt%, corresponding to (Rh<sub>0.79</sub>Pt<sub>0.11</sub>Ir<sub>0.09</sub>Fe<sub>0.08</sub>Co<sub>0.01</sub>)<sub>21.08</sub>(Sb<sub>0.91</sub>As<sub>0.04</sub>Bi<sub>0.04</sub>Sn<sub>0.02</sub>)<sub>21.01</sub>S<sub>0.91</sub> and (Rh<sub>0.93</sub>Fe<sub>0.12</sub>Ir<sub>0.03</sub>Pt<sub>0.02</sub>)<sub>21.10</sub>(Sb<sub>0.65</sub>Bi<sub>0.32</sub>Sn<sub>0.02</sub>As<sub>0.02</sub>)<sub>21.01</sub>S<sub>0.90</sub>. Analysis of the (Pt,Fe)(Bi,Sb) phase gave Pt 39.2; Fe 3.3, Cu 0.4, Bi 49.0; Sb 6.5, sum 98.4 wt%, corresponding to (Pt<sub>0.72</sub>Fe<sub>0.21</sub>Cu<sub>0.02</sub>)<sub>20.95</sub>(Bi<sub>0.85</sub>Sb<sub>0.19</sub>)<sub>21.04</sub>.

**Discussion.** The occurrence of unnamed RhNiAs at other localities was abstracted in *Am. Mineral.* 69, p. 1080, 1984; and in *Am. Mineral.* 76, p. 1437 and 1438, 1991; also reported recently in *Doklady Akad. Nauk* 325(5), 1026–1029, 1992. Unnamed (Pd,Pt)<sub>4</sub>(Cu,Fe)<sub>2</sub>(Sn,Sb)<sub>3</sub> could correspond to cuprian paolovite if the formula were written as (Pd,Pt,Cu,Fe)<sub>2</sub>(Sn,Sb). Unnamed Pt<sub>3</sub>Sb is known as a synthetic compound. The phases reported as (Rh,Pt)SbS and (Rh,Fe)(Sb,Bi)S presumably are identical to the mineral abstracted in *Am. Mineral.* 67, p. 1080, 1982; and may be identical to the Rh-Sb-S phase abstracted in *Am. Mineral.* 72, p. 1217, 1989. PtBi is known synthetically and may be identical to Pd(Bi,Sb) reported in *Am. Mineral.* 72, p. 228, 1987. J.L.J.

**(NH<sub>4</sub>)<sub>2</sub>Mg(SO<sub>4</sub>)<sub>2</sub>·4H<sub>2</sub>O, CaCl<sub>2</sub>, PbO, 2FeCl<sub>3</sub>·5H<sub>2</sub>O**

B.V. Chesnokov, L.F. Bazhenova, E.P. Shscherbakova, T.A. Michal, T.N. Deriabina (1988) New minerals from the burned dumps of the Chelyabinsk coal basin. In *Mineralogy, technogenesis, and mineral-resource complexes of the Urals*. Akad. Nauk SSSR—Uralskoe Otdel. 5–31 (in Russian).

The following phases are reported to be products of fumarole-type activity that originates through the burning of coal dumps at the Chelyabinsk basin, Russia.

**(NH<sub>4</sub>)<sub>2</sub>Mg(SO<sub>4</sub>)<sub>2</sub>·4H<sub>2</sub>O**

Descriptions of the properties of (NH<sub>4</sub>)<sub>2</sub>Mg<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> and NH<sub>4</sub>(Al,Fe)(SO<sub>4</sub>)<sub>2</sub> are given; the phases have since been named efremovite (*Am. Mineral.* 76, p. 299, 1991) and godovikovite (*Am. Mineral.* 75, 241–242, 1990). Associated with efremovite is an anisotropic substance corresponding to that of synthetic (NH<sub>4</sub>)<sub>2</sub>Mg(SO<sub>4</sub>)<sub>2</sub>·4H<sub>2</sub>O, as given in PDF 18–111; the natural phase would be the NH<sub>4</sub> analogue of leonite.

**CaCl<sub>2</sub>**

Occurs at mine 45 as extremely hygroscopic white grains in silicified wood and in the burned dump. Positive reactions for Ca and Cl, and an X-ray powder pattern that matches that of synthetic CaCl<sub>2</sub>.

**PbO<sub>2</sub>**

Occurs as brown coatings, up to 1 mm thick, on massicot at mine 22. The X-ray pattern has strongest lines of 3.093(100,111), 1.895(90,222), 1.617(90,311), 1.229-(50,331), 1.199(50,420), and 1.095(70,422),  $a = 5.361 \text{ \AA}$ , in good agreement with data for synthetic cubic PbO<sub>2</sub> (PDF 22–389). Brittle,  $H = \sim 4$ ; Pb and traces of Fe detected by laser microanalysis. The phase was formed by the transformation of Pb, litharge, and massicot.

**2FeCl<sub>3</sub>·5H<sub>2</sub>O(?)**

Occurs as goldish yellow, transparent, thin, bent fibers in chloride accumulations in the burned dumps of mines 45 and 50. The X-ray pattern, similar to that of synthetic 2FeCl<sub>3</sub>·5H<sub>2</sub>O, has strongest lines of 4.17, 2.96, and 2.39 Å. Hygroscopic, converting to a yellow liquid;  $H = 2$ ; yields H<sub>2</sub>O in a closed tube, and in a flame quickly boils and forms a black magnetic ball. In immersion oil, yellow color, isotropic  $n = 1.720$ .

**Discussion.** The strongest diffraction lines for the analogous 2FeCl<sub>3</sub>·5H<sub>2</sub>O synthetic phase (PDF 1–0240) are 5.08(100), 4.50(50), 4.16(20), 3.49(20), and 2.98(50). CaCl<sub>2</sub> corresponds to the mineral hydrophilite. Efremovite, godovikovite, and a large variety of sulfates have also been reported to occur in material from burning coal dumps near Kladno, Czech Republic (V. Žáček, *Acta Univ. Carolinae, Geol.*, No. 3, 315–341, 1988; in Czech, English abstract). **J.P.**

**K<sub>2</sub>TiSi<sub>3</sub>O<sub>9</sub>**

R.H. Mitchell, I. Steele (1992) Potassian zirconium and titanium silicates and strontian cerian perovskite in lamproites from the Leucite Hills, Wyoming. *Can. Mineral.*, 30, 1153–1159.

Seven electron microprobe analyses and corresponding structural formulas are tabulated for a potassian mineral that is intergrown with wadeite and may be its Ti analogue, K<sub>2</sub>(Ti,Zr)Si<sub>3</sub>O<sub>9</sub>. Ti values are up to 22.3 wt%, and all Zr values are <2%. **J.L.J.**

**New Data****Cebaite, huanghoite, zhonghuacerite**

N. Mercier, M. Leblanc (1993) Crystal growth and structures of rare earth fluorocarbonates. I. Structures of BaSm(CO<sub>3</sub>)<sub>2</sub>F and Ba<sub>3</sub>La<sub>2</sub>(CO<sub>3</sub>)<sub>5</sub>F<sub>2</sub>: Revision of the corresponding huanghoite and cebaite type structures. *Eur. Jour. Solid State Inorg. Chem.*, 30, 195–205.

N. Mercier, M. Leblanc (1993) Crystal growth and structures of rare earth fluorocarbonates. II. Structures of zhonghuacerite Ba<sub>2</sub>Ce(CO<sub>3</sub>)<sub>3</sub>F. Correlations between huanghoite, cebaite and zhonghuacerite type structures. *Eur. Jour. Solid State Inorg. Chem.*, 30, 207–216.

Single-crystal X-ray structures were determined for synthetic Ba<sub>3</sub>La<sub>2</sub>(CO<sub>3</sub>)<sub>5</sub>F<sub>2</sub> ( $R = 0.022$ ), Ba<sub>2</sub>Ce(CO<sub>3</sub>)<sub>3</sub>F ( $R = 0.019$ ), and BaSm(CO<sub>3</sub>)<sub>2</sub>F ( $R = 0.19$ ). The last, which corresponds to the Sm analogue of huanghoite-(Ce), has  $a = 5.016(1)$ ,  $c = 37.944(5) \text{ \AA}$ , rhombohedral space group  $R\bar{3}m$  rather than  $R3m$ . Ba<sub>3</sub>La<sub>2</sub>(CO<sub>3</sub>)<sub>5</sub>F<sub>2</sub> corresponds to the La analogue of cebaite-(Ce) and has similar cell dimensions, but the space group has been specifically determined as  $C2/m$ . Ba<sub>2</sub>Ce(CO<sub>3</sub>)<sub>3</sub>F corresponds to the formula of zhonghuacerite-(Ce), but the synthetic phase is monoclinic rather than trigonal, space group  $P2_1/m$ ,  $a = 13.365(3)$ ,  $b = 5.097(1)$ ,  $c = 6.638(1) \text{ \AA}$ ,  $\beta = 106.45(2)^\circ$ ,  $D_{\text{calc}} = 4.702 \text{ g/cm}^3$ , with  $Z = 2$ . The structures of zhonghuacerite and cebaite can be derived from that of huanghoite by the hypothetical elimination of units (of MCO<sub>3</sub>F) along planes parallel to (01 $\bar{1}$ 2) in huanghoite.

**Discussion.** Redefinition of the symmetry of zhonghuacerite-(Ce) needs confirmation by examination of natural specimens. **J.L.J.**

**Revdite**

R.K. Rastsvetaeva, M.G. Mikheeva, N.A. Yamnova, D.Yu. Pushcharovskii (1992) Crystal structure of revdite Na<sub>16</sub>[Si<sub>4</sub>O<sub>6</sub>(OH)]<sub>2</sub>[Si<sub>8</sub>O<sub>15</sub>(OH)]<sub>6</sub>(OH)<sub>10</sub>·28H<sub>2</sub>O. *Soviet Physics Crystallogr.*, 37(5), 632–636.

Single-crystal X-ray structural study ( $R = 0.084$ ) of revdite from the Lovozero massif (type locality) gave monoclinic symmetry, space group  $C2$ ,  $a = 5.383(4)$ ,  $b = 9.972(9)$ ,  $c = 6.907(4) \text{ \AA}$ ,  $\beta = 96.78(1)^\circ$ , with the formula given above and  $Z = 2$ ,  $D_{\text{calc}} = 1.93$ ,  $D_{\text{meas}} = 1.94 \text{ g/cm}^3$ . The symmetry, cell, and formula are new. **J.L.J.**