

New Mineral Names*†

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This New Mineral Names has entries for eight new minerals, including anatacamite, běhounekite, eringaite, horomanite, kobokoboite, kurilite, momoite, and samaniite. These new minerals have been published in *Neues Jahrbuch für Mineralogie Abhandlungen*, *Mineralogical Magazine*, *Journal of Mineralogical and Petrological Sciences*, and *European Journal of Mineralogy*.

ANATACAMITE*

T. Malcherek and J. Schlüter (2010) Anatacamite from La Vendida mine, Sierra Gorda, Atacama desert, Chile: a triclinic polymorph of $\text{Cu}_2(\text{OH})_3\text{Cl}$. *Neues Jahrbuch für Mineralogie Abhandlungen*, 187, 307–312.

Anatacamite (IMA 2008-042), ideally $\text{Cu}_2(\text{OH})_3\text{Cl}$, is a new mineral from La Vendida mine (an abandoned open pit copper mine) in the Sierra Gorda mining district, northeast of Antofagasta, Chile. The mineralization is bound to dacitic-andesitic volcanic breccias. Associated minerals are atacamite and belloite, as well as other minerals of the oxidation zone as alunite, clinoatacamite, chalcantite, coquimbite, eriochalcite, jarosite, kröhnkite, magnesioaubertite, tamarugite, and voltaite. Anatacamite occurs as triangular, tabular, emerald-green crystals, up to about 2 mm in length, grown on {011} of prismatic atacamite crystals. Observed forms are {11 $\bar{1}$ }, {1 $\bar{1}$ 1}, {100}, and { $\bar{1}$ 11}. Microscopical examinations reveal distinctive pseudo-merohedral twinning. The mineral has a pale green streak and shows no fluorescence. Anatacamite crystals are transparent with a vitreous luster. Vickers microhardness is $\text{VHN}_{50} = 350 \text{ kg/mm}^2$, corresponding to a Mohs hardness of about 4–4½. Crystals are brittle, show conchoidal fracture, and have a good cleavage parallel to (11 $\bar{1}$). The calculated density from the empirical formula and unit cell is 3.725 g/cm^3 . Anatacamite crystals are biaxial, with $n = 1.80$, estimated from Gladstone-Dale constants using the empirical formula and single-crystal unit-cell data. Anatacamite appears non-pleochroic. It is not soluble in water. Electron microprobe analyses (in wavelength-dispersive mode), yielded the average composition (wt%): CuO 74.24, ZnO 0.02, NiO 0.99, Cl 16.98, H₂O 12.74 (calculated by stoichiometry) (Cl≡O –3.84), total 101.133, yielding an empirical formula, based on (O + OH + Cl) = 4, of: $\text{Cu}_{1.97}\text{Ni}_{0.03}(\text{OH})_{2.99}\text{Cl}$, and a simplified formula of $\text{Cu}_2(\text{OH})_3\text{Cl}$, which requires: CuO 74.49, Cl 16.65,

H₂O 12.62, (Cl≡O –3.76) total 100 wt%. X-ray powder-diffraction data were obtained by Gandolfi-type measurements. The six strongest lines in the powder X-ray diffraction pattern are [d_{obs} in Å ($I_{\text{obs}}\%$, hkl): 5.432 (100, $\bar{1}11, 1\bar{1}1, \bar{1}\bar{1}1$); 2.747 (94, 013, $\bar{1}13, \bar{1}31, 031, 1\bar{1}3, \bar{1}31, 3\bar{1}1, 3\bar{1}\bar{1}, 222, 2\bar{2}2, \bar{2}\bar{2}2$); 2.257 (56, 004, 040, 400); 2.889 (31, $\bar{1}31, \bar{1}\bar{1}3, \bar{3}11$); 1.702 (29, 440, 404, 044); 1.812 (21, $\bar{3}33, \bar{1}\bar{1}5, 1\bar{5}1, 3\bar{3}3, 511, 3\bar{3}3$). Single-crystal data yielded a triclinic unit-cell with: $a = 9.1646(9)$, $b = 9.2029(8)$, $c = 9.2102(8)$ Å, $\alpha = 95.858(6)$, $\beta = 96.290(7)$, $\gamma = 96.507(2)^\circ$, $V = 761.97(12)$ Å³, $Z = 8$, space group $P\bar{1}$. Structure refinement converged to $R = 0.041$ for 6622 reflections with $I > 3\sigma(I)$. Anatacamite structure forms a network of edge-sharing distorted octahedra. Within layers, Cu atoms are axially coordinated by two Cl and equatorially coordinated by four OH (intra-layer octahedra). The layers are connected by $\text{Cu}(\text{OH})_6$ octahedra (inter-layer octahedra) that share edges with the intra-layer octahedra. Until discovery and characterization of anatacamite, pure $\text{Cu}_2(\text{OH})_3\text{Cl}$ was known to occur in the form of two monoclinic polymorphs (botallackite and clinoatacamite) and one orthorhombic polymorph (atacamite). While anatacamite is easily identified by single-crystal X-ray diffraction, it is very difficult to distinguish it from clinoatacamite in X-ray powder diffraction experiments. Anatacamite is named for its triclinic symmetry and its polymorphism with atacamite. The holotype is preserved in the collection of the Mineralogical Museum of the University of Hamburg, Germany (MD 199).

F.C. and G.D.G.

BĚHOUNEKITE*

J. Plášil, K. Fejfarová, M. Novák, M. Dušek, R. Škoda, J. Hloušek, J. Čejka, J. Majzlan, J. Sejkora, V. Machovič, and D. Talla (2011) Běhounekite, $\text{U}(\text{SO}_4)_2(\text{H}_2\text{O})_4$, from Jáchymov (St Joachimsthal), Czech Republic: the first natural U^{4+} sulphate. *Mineralogical Magazine*, 75, 2739–2753.

The new mineral běhounekite has been discovered at the Geschieber vein (10th level, Svornost/Einigkeit shaft) at the intersection with the Geier vein structure, Jáchymov (St Joachimsthal) ore district, Krušné hory Mts., Western Bohemia, Czech Republic (50° 22' 21.138 N, 12° 54' 46.251 E). It occurs on highly altered native arsenic in direct associa-

* All minerals marked with an asterisk have been approved by the IMA CNMMC.

† For a complete listing of all IMA-validated unnamed minerals and their codes, see <http://pubsites.uws.edu.au/ima-cnmmc/>.

tion with arsenolite, kaatialaite, claudetite, gypsum, trögerite related mineral, and unnamed mineral UM1997-20-AsO:HU. Běhounekite usually forms green short-prismatic to tabular crystals up to 0.5 mm long or, less commonly, long prismatic crystals. The crystals have a strong vitreous luster and a gray to greenish gray streak. They are brittle with an uneven fracture and have perfect cleavage along {100}. The Mohs hardness is about 2. The mineral does not fluoresce in short- nor in long-wavelength UV radiation. Běhounekite is optically biaxial (+) with $\alpha = 1.590(2)$, $\beta = 1.618(4)$, $\gamma = 1.659(2)$ (for $\lambda = 590$ nm), $2V_{\text{calc}} = 81^\circ$. It is moderately pleochroic Z (emerald green) $> X, Y$ (pale emerald green). The density was not measured; $D_{\text{calc}} = 3.62$ g/cm³. The detail vibration spectroscopy study of běhounekite was performed in comparison with synthetic $\text{U}(\text{SO}_4)_2(\text{H}_2\text{O})_4$. The dominant peaks on the Raman and IR spectra of běhounekite are assigned to (cm⁻¹): bending vibrations of SO_4 tetrahedra (~400–460) and (~590–640), stretching vibrations of SO_4 tetrahedra (~950–1200), bending vibrations of structurally non-equivalent H_2O molecules (~1600–1680) and O–H stretching vibrations of hydrogen bonded H_2O molecules (~3000–3400). The average of 5 microprobe (WDS) analyses [wt% (range)] yield: Y_2O_3 0.75 (0.55–0.91), SO_3 31.36 (30.96–31.82), UO_2 53.40 (52.69–53.88), H_2O 14.53 (calculated on the basis of a theoretical content of $4\text{H}_2\text{O}$), total 100.04. The empirical formula of běhounekite based on 12 O atoms [the presence of Ce_2O_3 0.11, Nd_2O_3 0.26, Gd_2O_3 0.26, Dy_2O_3 0.2, Er_2O_3 0.06, total 0.89 wt%, (<0.02 apfu), was not considered] is $(\text{U}_{0.99}\text{Y}_{0.03})_{\Sigma 1.02}(\text{SO}_4)_{1.97}(\text{H}_2\text{O})_4(\text{OH})_{0.11}$. The OH content was calculated to maintain charge balance, however IR and structural data show no evidence of the (OH) groups presence. The simplified formula is $\text{U}(\text{SO}_4)_2(\text{H}_2\text{O})_4$. The strongest X-ray powder diffraction lines [d_{obs} in Å ($I_{\text{obs}}\%$, hkl)] are: 7.330 (100, 200), 6.112 (54, 210), 5.538 (21, 020), 4.787 (42, 111), 3.663 (17, 400), 3.478 (20, 410), 3.080 (41, 321), 2.495 (17, 122). Běhounekite is orthorhombic, space group $Pnma$, $a = 14.6464(3)$, $b = 11.0786(3)$, $c = 5.6910(14)$ Å, $V = 923.43$ Å³, $Z = 4$. The crystal structure of běhounekite has been solved by the charge-flipping method from single-crystal X-ray diffraction data and refined to $R = 0.0209$ based on 912 unique reflections with $I_{\text{obs}} > 3\sigma(I)$. The crystal structure consist of $\text{U}(\text{SO}_4)_2(\text{H}_2\text{O})_4$ sheets perpendicular to [100], which are linked via hydrogen bonds. The sheets consists of UO_8 polyhedra and bridging SO_4 tetrahedra. Four oxygen atoms of UO_8 polyhedron belong to the SO_4 groups and other four to the H_2O molecules. Each U polyhedron is connected via SO_4 tetrahedra with other U polyhedra and through hydrogen bonds to the apices of SO_4 tetrahedra. Calculated bond-valence sums confirm that uranium is tetravalent. The mineral is named in honour of Professor František Běhounek (1898–1973), a well-known Czech nuclear physicist. The mineral and the name were approved by CNMNC (IMA 2010-046). The holotype specimen is deposited in the mineralogical collections of the National Museum in Prague, Czech Republic. **D.B.**

ERINGAITE*

I.O. Gałuska, E.V. Gałuskin, B. Lazic, T. Armbruster, P. Dzierżanowski, K. Prusik, and R. Wrzalik (2010) Eringaite, $\text{Ca}_3\text{Sc}_2(\text{SiO}_4)_3$, a new mineral of the garnet group. *Mineralogical Magazine*, 74, 365–373.

Eringaite (IMA2009-054), ideally $\text{Ca}_3\text{Sc}_2(\text{SiO}_4)_3$, is a new mineral species of the garnet group from the Wiluy River, Sakha-Yakutia Republic, Russia. It is an accessory mineral in metasomatic rodingite-like rocks; it forms regular growth zones and irregular spots in complex garnet crystals containing a kimzeyite core. In these rodingite-like rocks, eringaite coexists with grossular, vesuvianite, serpentine, and melilite-group minerals. Accessory minerals of the host rock are: diopside and fassaitic pyroxene, wiluite, perovskite, zircon, baghdadite, magnetite, hematite, titanite, fluorapatite, chlorite of the clinchlore–chamosite series, and calcite. Eringaite is light brown to yellow, with a creamy white streak. The crystals are transparent and have vitreous luster. The mineral has no cleavage and its fracture is irregular. The size of the eringaite crystals with the greatest Sc_2O_3 content did not exceed 10 μm . Hardness was not determined due to the small crystal size. Optical parameters were not measured. The calculated density is 3.654 g/cm³. Electron microprobe analyses (in wavelength-dispersive mode), yielded the average composition [wt% (range)]: SiO_2 29.39 (29.12–29.61), TiO_2 7.17 (6.85–8.14), ZrO_2 5.28 (5.03–5.41), HfO_2 0.14 (0.12–0.16), Al_2O_3 3.15 (3.06–3.25), Sc_2O_3 10.67 (9.92–11.20), Y_2O_3 0.20 (0.15–0.29), V_2O_5 0.14 (0.06–0.23), Cr_2O_3 1.05 (0.99–1.13), Fe_2O_3 8.48 (8.01–9.49), FeO 0.50 (0.04–0.88), MnO 0.01 (0–0.03), CaO 33.19 (32.62–33.45), MgO 0.95 (0.84–1.08), total 100.31. The empirical formula for eringaite, calculated on the basis of 12 oxygen atoms per formula unit, is: $(\text{Ca}_{2.98}\text{Y}_{0.01}\text{Mg}_{0.01})_{\Sigma 3.00}(\text{Sc}_{0.82}\text{Ti}_{0.44}\text{Fe}_{0.30}^{3+}\text{Zr}_{0.21}\text{Mg}_{0.10}\text{Al}_{0.09}\text{Cr}_{0.08}\text{Fe}_{0.05}^{2+}\text{V}_{0.01}^{3+})_{\Sigma 2.01}(\text{Si}_{2.48}\text{Al}_{0.30}\text{Fe}_{0.22}^{3+})_{\Sigma 3.00}\text{O}_{12}$, $Z = 8$. The symmetry and cell parameters determined by electron backscatter diffraction (EBSD) yielded a model with $a = 12.19$ Å. The unit-cell parameter of a larger crystal ($0.02 \times 0.02 \times 0.03$ mm) with a slightly different composition [i.e., $(\text{Ca}_{3.00}\text{Y}_{0.01})_{\Sigma 3.01}(\text{Sc}_{0.63}\text{Ti}_{0.66}\text{Fe}_{0.25}\text{Zr}_{0.30}\text{Mg}_{0.08}\text{Cr}_{0.06}\text{Fe}_{0.01}^{2+})_{\Sigma 1.99}(\text{Si}_{2.13}\text{Al}_{0.26}\text{Fe}_{0.61}^{3+})_{\Sigma 3.00}\text{O}_{12}$] was determined by single-crystal X-ray diffraction, giving: $a = 12.255(1)$ Å and reflection conditions consistent with the space group $Ia\bar{3}d$. The calculated X-ray powder diffraction lines (based on a model with $a = 12.19$ Å, space group $Ia\bar{3}d$) are as follows [(hkl) d_{hkl} in Å ($I\%$)]: (400) 3.064 (69), (420) 2.740 (100), (422) 2.502 (68), (640) 1.670 (30), (642) 1.638 (82), (840) 1.370 (20), (842) 1.137 (19), (10.4.2) 1.119 (29). The following Raman bands were found in unpolarized spectra of eringaite (strong bands are in italic, cm⁻¹): 219, 254, 310, 335, 362, 412, 443, 511, 543, 600, 640, 735, 803, 880, and 937. The name eringaite originates from the Eringa River, the tributary of the Wiluy River. The type specimen is deposited in the collection of the Fersman Mineralogical Museum in Moscow (Russia). **G.D.G. and F.C.**

HOROMANITE*, SAMANIITE*

A. Kitakaze, H. Itoh, and R. Komatsu (2011) Horomanite, $(\text{Fe,Ni,Cu})_9\text{S}_8$, and samaniite, $\text{Cu}_2(\text{Fe,Ni})_7\text{S}_8$, new mineral species from the Horoman peridotite massif, Hokkaido, Japan. *Journal of Mineralogical and Petrological Sciences*, 106, 204–210.

Two new minerals horomanite (IMA 2007-037) and samaniite (IMA 2007-038) were discovered in sulfide aggregates, which are filling interstices between olivine, clino- and orthopyroxens in lherzolites of the Horoman peridotite massif, Samani-cho,

Samani-gun, Hokkaido, Japan. In these sulfide aggregates the minerals were previously mentioned with incomplete description (Kitakaze, 1998) as mineral X (now horomanite), mineral Z (now samaniite), and mineral Y [recently described sugakiite $\text{Cu}(\text{Fe},\text{Ni})_8\text{S}_8$; Kitakaze 2008]. Those three minerals occur in intimate intergrowths. Samaniite and sugakiite sometimes occur as lammellae in horomanite. The size of the mineral grains is 0.05–0.1 mm. Other associated minerals are: bornite, talnakhite, copper, troilite, heazlewoodite, pentlandite, and magnetite. Macroscopically both horomanite and samaniite look like a white alloy with a yellowish tint and metallic luster. Both are brittle and have uneven fracture. Mohs hardness is close to 3.

Horomanite has a pronounced cleavage. In reflected light it is white with yellowish tint with no internal reflections. Pleochroism is very weak (white with a yellowish tint to white). The mineral is weakly anisotropic (dark-gray to slightly light-gray). The reflectance values in air [$R_{\text{min}}/R_{\text{max}}\%$ (nm)] are: 34.7/37.8 (436), 40.0/43.2 (497), 43.2/46.4 (543), 45.4/48.5 (586), 47.8/50.7 (648). The mineral $\text{VHN}_{50} = 135$ (125–145) kg/mm^2 . The average of 15 microprobe (WDS) analyses [wt% (range)] yield: Cu 0.43 (0.10–0.89), Fe 41.82 (40.31–43.77), Ni 23.76 (21.31–25.75), Co 0.52 (0.39–0.83), S 33.29 (32.99–33.70), total 99.82. The empirical formula based on S = 8 apfu is $(\text{Fe}_{5.77}\text{Ni}_{3.12}\text{Co}_{0.07}\text{Cu}_{0.05})_{\Sigma 9.01}\text{S}_8$. The strongest X-ray powder diffraction lines [d_{obs} in Å ($I_{\text{obs}}\%$, hkl)] are: 6.16 (10, 110), 3.080 (100, 220), 2.955 (32, 221), 1.984 (25, 323), 1.947 (51, 420), 1.825 (60, 422), 1.805 (54, 413). Horomanite is tetragonal, space group $P4/mmm$. The unit-cell parameters are: $a = 8.707(1)$, $c = 10.436(6)$ Å, $V = 791.17$ Å³, $Z = 4$. $D_{\text{calc}} = 6.44$ g/cm^3 for an ideal formula $\text{Fe}_6\text{Ni}_3\text{S}_8$.

Samaniite has no cleavage. In reflected light it is yellowish-white with no internal reflections. Pleochroism is weak (yellowish-white to pale yellowish-white). The mineral is weakly anisotropic (dark-gray to light-gray). The reflectance values in air [$R_{\text{min}}/R_{\text{max}}\%$ (nm)] are: 27.1/29.6 (436), 34.4/37.9 (497), 38.9/43.6 (543), 44.9/49.8 (586), 42.2/46.9 (648). $\text{VHN}_{50} = 130$ (120–140) kg/mm^2 . The average of 10 microprobe (WDS) analyses [wt% (range)] yield: Cu 16.90 (16.08–17.80), Fe 34.60 (32.81–36.85), Ni 15.48 (13.47–17.90), Co 0.16 (0.11–0.28), S 32.87 (32.78–32.97), total 100.01. The empirical formula based on S = 8 apfu is $\text{Cu}_{2.08}(\text{Fe}_{4.84}\text{Ni}_{2.06}\text{Co}_{0.02})_{\Sigma 6.92}\text{S}_8$. The strongest X-ray powder diffraction lines [d_{obs} in Å ($I_{\text{obs}}\%$, hkl)] are: 5.88 (15, 111), 3.118 (100, 113), 3.050 (20, 311), 1.873 (25, 520), 1.844 (50, 521), 1.595 (45, 620). Samaniite is tetragonal, space group $P4_2/mmm$. The unit-cell parameters are: $a = 10.089(1)$, $c = 10.402(8)$ Å, $V = 1058.8$ Å³, $Z = 4$. $D_{\text{calc}} = 4.89$ g/cm^3 for an ideal formula $\text{Cu}_2\text{Fe}_5\text{Ni}_2\text{S}_8$.

The density for both minerals could not be measured due to small size of its grains. X-ray powder diffraction data were obtained using Gandolfi camera (filtered $\text{CuK}\alpha$ radiation). The unit-cell parameters were determined from powder diffraction data. The hkl were indexed based on single-crystal X-ray study by the precession method. No data on crystal structure provided. The origin of horomanite, samaniite, and sugakiite is discussed as a result of dissolution at the temperature below 760 °C. Both species were named for the locality. The minerals and their names were approved by CNMNC IMA. Type specimens are deposited at the Tohoku University Museum, Japan. **D.B.**

Comment: Horomanite and samaniite are mentioned as UM1998-16-S:FeNi (designated mineral “X”) and UM1998-

14-S:CuFeNi (designated mineral “Z”), respectively, at the IMA CNMNC list of valid unnamed minerals (update 2012-01; <http://pubsites.uws.edu.au/ima-cnmc>, Smith and Nickel 2007).

Discussion: It seems strange that among related minerals (horomanite, samaniite, sugakiite, and pentlandite), which have the same number of atoms per formula unit (i.e., 17), very similar composition, hardness, and reflective values, horomanite differs significantly in density (6.44 calc) while others have it as 4.89, 4.76, 4.96 g/cm^3 , respectively. The density for horomanite calculated for $Z = 3$ is in the same row (4.83 g/cm^3). Otherwise the cell parameters might need to be redefined.

References cited

- Kitakaze, A. (1998) Sulfide minerals from Horoman peridotite, Hokkaido, Japan. *Journal of Mineralogy, Petrology and Economic Geology*, 93, 369–379 (In Japanese with English abstract).
 — (2008) Sugakiite $\text{Cu}(\text{Fe},\text{Ni})_8\text{S}_8$ a new mineral from Hokkaido, Japan. *Canadian Mineralogist*, 46, 263–267.
 Smith, D.G.W., and Nickel, E.H. (2007) A System of Codification for Unnamed Minerals: Report of the SubCommittee for Unnamed Minerals of the IMA Commission on New Minerals, Nomenclature and Classification. *Canadian Mineralogist*, 45, 983–1055.

KOBOKOBOITE*

S.J. Mills, W.D. Birch, A.R. Kampf, and L. van Wambeke (2010) Kobokoboite, $\text{Al}_6(\text{PO}_4)_4(\text{OH})_6 \cdot 11\text{H}_2\text{O}$, a new mineral from the Kobokobo pegmatite, Democratic Republic of the Congo. *European Journal of Mineralogy*, 22, 305–308.

Kobokoboite (IMA2009-057), ideally $\text{Al}_6(\text{PO}_4)_4(\text{OH})_6 \cdot 11\text{H}_2\text{O}$, is a new mineral from the Kobokobo pegmatite, South Kivu Province, Democratic Republic of the Congo. The Kobokobo pegmatite is classified as belonging to the LCT family, rare-element class, Li subclass, beryl type, beryl-columbite/beryl-phosphate subtype. An upper branch of the pegmatite contained Th-rich uraninite, fluorapatite, and primary Li-Fe-Mn phosphates. Late-stage hydrothermal activity and supergene reactions have strongly altered this assemblage and remobilized elements such as Al, Ca, P, and U to form a suite of rare minerals. Kobokoboite is interpreted as one of the latest forming minerals in the Kobokobo assemblage, as a result of supergene weathering of the upper branch of the albite-beryl-microcline pegmatite. Kobokoboite occurs as crusts and coatings of pearly white, glistening, platy crystals. The crusts are 0.1–0.15 mm thick. Investigations in scanning electron microscopy showed that individual crystals are pseudo-hexagonal plates or flattened blades on (001), the dominant form being {001}. Crystals range up to about 50 μm across and of the order of a few micrometers thick. Kobokoboite crystals are translucent but transparent on edge, show a pearly luster, have a white streak, and are non-fluorescent in short- or long-wave ultraviolet light. Estimated Mohs hardness is about 2, the tenacity is brittle, fracture is irregular. No cleavage or parting or twinning was observed. The measured density (sink-float method in an aqueous solution of sodium polytungstate) is 2.21(3) g/cm^3 , the calculated density from the empirical formula and unit cell is 2.287 g/cm^3 . Kobokoboite crystals are biaxial negative, with $\beta = 1.558(2)$ and $\gamma = 1.562(2)$ measured in white light; it was not possible to measure α . $2V$ ranges between 60 and 80°. With $2V = 70^\circ$, the calculated value of α is 1.556. Kobokoboite is non-pleochroic and the optical orientation is $X \approx c$; Y and Z could not be determined. Electron microprobe

analyses (in wavelength-dispersive mode), yielded the average composition (in wt%): Na₂O 0.06, CaO 0.18, Mn 0.01, Fe₂O₃ 1.31, Al₂O₃ 35.16, P₂O₅ 33.25, H₂O 29.52 (by CHN method), F 0.76 (F=O -0.32), total 99.93, yielding an empirical formula, based on (O + OH + F) = 33 apfu, of: (Al_{5.85}Fe_{0.14}Ca_{0.03}Na_{0.02})_{Σ6.04}(PO₄)_{3.97}[(OH)_{5.80}F_{0.34}]_{Σ6.14}·10.98H₂O. The simplified formula of kobokoboite is (Al,Fe)₆(PO₄)₄(OH)₆·11H₂O, and the end-member formula is Al₆(PO₄)₄(OH)₆·11H₂O, which requires: Al₂O₃ 36.33, P₂O₅ 33.71, H₂O 29.96, total 100 wt%. X-ray powder-diffraction pattern of kobokoboite was indexed giving a metrically triclinic lattice with: *a* = 7.460(1), *b* = 7.737(1), *c* = 12.385(5) Å, *α* = 102.79(2), *β* = 90.20(3), *γ* = 116.33(2)°, *V* = 620.6(3) Å³, *Z* = 1, space group *P*1 or *P*1̄. The five strongest lines in the powder X-ray diffraction pattern are [*d*_{obs} in Å (*I*_{obs}%, *hkl*)]: 11.990 (100, 001); 6.868 (45, 010); 3.552 (39, 21̄1, 111); 6.006 (33, 002); 3.081 (29, 12̄3, 201). A structure refinement of the kobokoboite structure was not possible. The chemistry and cell parameters of kobokoboite suggest a structural relationship with planerite. The type specimen is preserved in the collections of Museum Victoria (Melbourne, Australia). **G.D.G. and F.C.**

Discussion: The calculated value of one of the refractive indexes (1.556) is incorrect. This value should be 1.550 for the data given.

KURILITE *

V.A. Kovalenker, O.Yu. Plotinskaya, C.J. Stanley, A.C. Roberts, A.M. McDonald, and M.A. Cooper (2010) Kurilite—Ag₈Te₃Se—a new mineral from the Prasolovskoe deposit, Kuril islands, Russian Federation. *Mineralogical Magazine*, 74, 463–468.

Kurilite, ideally Ag₈Te₃Se, has been discovered at Prasolovskoe epithermal Au-Ag deposit, Kunashir Island, Kurilian Island chain, Russia, and named for locality. Basalts and rhyolitic tuffs of the Prasolovskoe caldera are intruded by a quartz diorite body and basalt or rhyolite dykes. Kurilite was found in quartz veins up to 500–600 m in length and 1–2 m thick with a vertical extension up to 270 m. Associated minerals are tennantite-tetrahedrite, goldfieldite, and rarely native gold, hessite, sylvanite, and petzite. Kurilite forms aggregates up to 2 mm, composed of anhedral grains up to several micrometers in size. The mineral is light- to steel-gray, opaque, metallic with a black streak. It is brittle and does not show any cleavage or parting. The Mohs hardness is about 3; VHN₂₅ = 100 (77–114) kg/mm². The density could not be measured due to small size of the grains; *D*_{calc} = 7.799 g/cm³. In reflected light, the mineral is white and resembles galena. It is isotropic without internal reflections. Reflectance data were obtained in air and in oil. For air the values [*R*% (nm)] are: 42.3 (400), 42.6 (420), 43.0 (440), 43.0 (460), **43.0 (470) COM**, 43.0 (480), 42.8 (500), 42.6 (520), 42.4 (540), **42.3 (546) COM**, 42.0 (560), 41.6.20 (580), **41.4 (589) COM**, 41.3 (600), 40.8 (620), 40.6 (640), **40.4 (650) COM**, 30.90 (660), 39.6 (680), 39.2 (700). The reflectance values are close to those of petzite and hessite but the reflectance curves of kurilite differ from those of petzite and hessite and are similar to cervelleite or aguilarite. The average of 7 microprobe (WDS) analyses [wt% (range)] yield: Ag 63.71 (63.01–64.46), Au 0.29 (0.13–0.46), Te 29.48 (29.13–29.78), Se 5.04 (4.50–5.33), S 0.07

(0.05–0.09), total 98.71. The empirical formula (based on 12 apfu) is (Ag_{7.97}Au_{0.02})_{Σ7.99}Te_{3.00}(Se_{0.86}Te_{0.12}S_{0.03})_{Σ1.01}. Single-crystal X-ray studies show the pseudocubic rhombohedral unit cell (*a* ≈ 11 Å) and suggest space group *R*3 or *R*3̄. The crystal structure could not be determined to *R* < 16% due to significant structural disorder. Powder X-ray diffraction data were obtained using a Debye-Scherrer camera *D* = 114.6 mm (filtered CuKα radiation). The strongest lines [*d*_{obs} in Å (*I*_{obs}%, *hkl*)] are: 6.55 (10, 003), 3.727 (20, 131), 2.996 (50, 232), 2.510 (30, 226,422), 2.201 (100, 128,416,342), 2.152 (20, 603), 2.079 (30, 253), 2.046 (20, 336,434). The X-ray data were indexed in trigonal system, space group *R*3̄. The unit-cell parameters: *a* = 15.80(1), *c* = 19.57(6) Å, *V* = 4231 Å³, *Z* = 15. The mineral and the name were approved by CNMNC (IMA 2009-080). The holotype specimen has been deposited at the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. The mineral was originally described (Kovalenker et al. 1989; abstracted by Jambor and Grew 1992) as (Ag,Au)₂(Te,Se,S), with a cubic cell (ICDD PDF database file 00-45-1399). At that time the mineral was not submitted to the IMA CNMNC, but still was formally discredited (Burke 2006) as being possibly equal to hessite or petzite. **D.B.**

References cited

- Burke, E.A.J. (2006) A mass discreditation of GQN minerals. *Canadian Mineralogist*, 44, 1557–1560.
Kovalenker, V.A., Nekrasov, I.Ya., Sandomirskaya, S.M., Nekrasova, A.N., Malov, V.S., Danchenko, V.Ya., and Dmitryeva, M.T. (1989) Sulfide-selenide-telluride mineralization of epithermal manifestations of Kurile-Kamchatka volcanic belt. *Mineralogicheskii Zhurnal*, 11, 3–18 (in Russian). Abstracted by J.L. Jambor and E.S. Grew (1992) *New Mineral Names*. *American Mineralogist*, 77, 207–213.

MOMOIITE*

H. Tanaka, S. Endo, T. Minakawa, M. Enami, D. Nishio-Hamane, H. Miura, and A. Hagiwara (2010) Momoiite, (Mn²⁺,Ca)₃(V³⁺,Al)₂Si₆O₃, a new manganese vanadium garnet from Japan. *Journal of Mineralogical and Petrological Sciences*, 105, 92–96.

Momoiite (IMA2009-026), ideally Mn₃²⁺V₂³⁺Si₆O₃, is a new silicate garnet from the Kurase mine, Ehime Prefecture, Japan (type locality). It has been also found in Hokkejino mine in Kyoto Prefecture and in Fujii mine in Fukui Prefecture, both in Japan. In Kurase mine the mineral occurs in a small-scale manganese ore deposits in pelite schist of the Sambagawa belt, associated with rhodonite, calcite, tephroite, goldmanite, spessartine, and vuorelainenite. In Hokkejino mine it occurs in a thermally metamorphosed ore deposit embedded in metachert of the Ryoke metamorphic belt, associated with rhodonite, tephroite, celsian, rhodochrosite, and pyrophanite. In the Fujii mine it occurs in a bedded manganese deposit developed in chert of the Tamba accretionary complex, with a moderate contact metamorphic grade, where momoiite occurs in quartz-free assemblages with rhodonite, tephroite, rhodochrosite, spessartine, nickeline, or in quartz-bearing assemblages with rhodonite, molybdenite, rhodochrosite, spessartine, and Mn-rich vanadoallanite-(La). Crystal aggregates in veins are up to 1 mm in the three localities, showing average crystal size <150–200 μm. Momoiite is translucent greenish-yellow to emerald-green in color. The greenish tinge correlates with the

V-content. Streak is dull green. Luster is vitreous. Mohs hardness is 6.5 and the calculated density from the empirical formula and unit cell is 4.01 g/cm³. Momoiite is optically isotropic with $n = 1.86(1)$ (for $\lambda = 589$ nm). Electron microprobe analyses (in wavelength-dispersive mode), yielded the average composition (in wt%): CaO 12.24, MnO 24.74, MgO 0.28, FeO 0.05, Al₂O₃ 5.12, V₂O₃ 21.96, SiO₂ 35.02, total 99.41, yielding an empirical formula, based on 12 O apfu, of: $(\text{Mn}_{1.80}\text{Ca}_{1.12}\text{Mg}_{0.12})_{\Sigma 2.96}(\text{V}_{1.51}\text{Al}_{0.52})_{\Sigma 2.03}\text{Si}_{3.00}\text{O}_{12}$. The simplified formula of momoiite is $(\text{Mn,Ca})_3(\text{V,Al})_2\text{Si}_3\text{O}_{12}$, and the ideal formula is $(\text{Mn}_3\text{V}_2\text{Si}_3\text{O}_{12})$, which requires: MnO 44.05, V₂O₃ 18.60, SiO₂ 37.35, total 100 wt%. X-ray powder-diffraction pattern of momoiite was indexed giving a metrically cubic lattice with: $a = 11.9242(7)$, $V = 1695.5(3)$ Å³, $Z = 1$, space group $Ia\bar{3}d$, on the basis of

systematic absences. The seven strongest lines in the powder X-ray diffraction pattern are [d_{obs} in Å (I_{obs} %, hkl)]: 2.980 (78, 400); 2.668 (100, 420); 2.435 (42, 510); 2.178 (20, 521); 1.935 (21, 611); 1.654 (20, 640); and 1.594 (30, 642). The chemistry and cell parameters of momoiite suggest a solid solution between spessartine, grossular, and goldmanite. The authors suggest that even in the presence of high V and Mn concentration in the ore, extreme momoiite-content is not found in the garnet because it formed in relatively low-pressure conditions in these metamorphic complexes. The mineral is named in honor of Hitoshi Momoi (1930–2002), who first recognized the presence of $\text{Mn}_3\text{V}_2\text{Si}_3\text{O}_{12}$ molecules in garnet. The type specimen is preserved in the collections of the Hokkaido University Museum (Sapporo, Japan). **F.C. and G.D.G.**