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New Mineral Names*

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In this issue

This New Mineral Names has entries for eight new minerals, including ferrotochilinite, ferrovalleriite, fluoro-potassic-pargasite, guidottiite, hydroxylchondrodite, hydroxymanganopyrochlore, lahnsteinite, and mariinskite. These new minerals have been published in *Clays and Clay Minerals*, *Doklady Akademii Nauk* (Doklady Earth Sciences), *Mineralogical Magazine*, and *Zapiski Rossiyskogo Mineralogicheskogo*, *Obshchestva* (Proceedings of the Russian Mineralogical Society).

Ferrotochilinite*

I.V. Pekov, E.V. Sereda, Yu.S. Polekhovsky, S.N. Britvin, N.V. Chukanov, V.O. Yapaskurt, and I.A. Bryzgalov (2012) Ferrotochilinite, $6FeS \cdot 5Fe(OH)_2$, a new mineral from Oktyabr'skoye ore deposit (Norilsk ore district, Siberia, Russia). Zap. Ross. Mineral. Obshch., 141(4), 1–11 (in Russian, English abstract).

An iron analogue of tochilinite $6FeS \cdot 5Mg(OH)_2$–ferrotochilinite, ideally $6FeS \cdot 5Fe(OH)_2$, has been reported from the Oktyabr'skiy mine, Oktyabr'skoye Cu-Ni-PGM deposit, Talnakh, Norilsk district, Krasnoyarskiy Kray, Russia. Fe-containing tochilinite (with Mg > Fe) is described from various localities. The Fe-rich tochilinite with Fe dominant over Mg in brucite-like layers was mentioned without detailed description in carbonaceous chondrites (Barber et al. 1983; Tomeoka and Buseck 1983; Mackinnon and Zolenskiy 1984). At the Oktyabr'skiy mine, the mineral is found in the cavities of the pentlandite-mooihoekite-cubanite ore with minor magnetite and chalcopyrite. Ferrotochilinite overgrows the light-green platy crystals of Fe-rich chlorite-type phyllosilicate that incrusts the cavities. Rarely, it overgrows hexagonal platy crystals of ferrovalleriite. This sequence is thought to be of low-temperature hydrothermal origin. The mineral forms flattened by (001) mostly split and curved prismatic to elongated lamellar crystals up to 0.1 × 0.5 × 3.2 mm or their fan- and rosette-like clusters, or chaotic aggregates up to 6.5 mm. Ferrotochilinite is often partly or entirely replaced by rust-colored aggregates of iron hydroxides and sulfates, and sometimes by covellite. When fresh the mineral is dark bronze-colored, metallic, with a black streak. It soon turns nearly black, dull, or tarnishes to iridescent purplish or golden-brown. The Mohs hardness is less then 1; VHN_2 is 13 (11–15) kg/mm^2. Cleavage by (001) is mica-like perfect. Individuals are flexible, inelastic. The density could not be measured; D_{calc} = 3.467 g/cm^3. In reflected light, ferrotochilinite is gray, with the hue changing from bluish (R_1) to pale beige (R_2); distinctly (ΔR = 2.6% at 589 nm) bireflectant. Anisotropy is distinct, with gray-bluish to yellowish-beige rotation colors. No internal reflections were observed. Reflectance values were measured between 400 and 700 nm in 20 nm interval. The values for (COM) wavelengths [R_1, R_2, % (nm)] are: 11.6, 11.4 (470), 11.2, 12.4 (546), 11.1, 13.6 (589), 11.0, 15.5 (650). IR spectrum was obtained using FTIR spectrometer with 4 cm^{-1} resolution. It is similar to those of tochilinite and ferrovalleriite. IR absorption bands (cm^{-1}, w = weak, sh = shoulder) are: 3515sh, 3457 (stretching vibrations O–H), 1634w (H_2O molecules absorbed or due to alteration products), 801, 615sh (bending vibrations $Fe^{2+}\cdots O$ –H), 477 stretching vibrations $Fe^{2+}\cdots O$. The average of nine microprobe (EDS and WDS) analyses [wt% (range)] is Mg 0.02 (0–0.03), Fe 61.92 (60.1–62.6), Ni 0.03 (0–0.11), Cu 0.09 (0–0.21), S 19.45 (18.3–20.0), O 16.3 (15.7–17.1), H (calculated considering OH group presence only) 1.03, total 98.84. The empirical formula calculated on the basis of 6 S atoms is: $Mg_{0.01}Fe_{10.96}Ni_{0.005}Cu_{0.015}S_6(OH)_{10.07}$ or $(Fe_{5.98}Cu_{0.015}Ni_{0.005})S_6(Fe^{2+}_{4.89}Mg_{0.01})(OH)_{9.80}Fe^{3+}_{0.09}(OH)_{0.27}$. The Fe^{2+}/Fe^{3+} ratio was calculated based on charge balance. Powder X-ray diffraction data were obtained by Gandolfi method (Mo$K\alpha$ radiation) using single-crystal diffractometer. The strongest lines of the powder diffraction pattern [d_{obs} (Å) (I_{obs}%, *hkl*)] are: 10.83 (13, 001), 5.392 (100, 002), 3.281 (7, 023), 2.777 (7, 150), 2.696 (12, 004, 201), 2.524 (12, 221, 202), 2.152 (8, 134, 153), 1.837 (11, 135, 173). Ferrotochilinite is monoclinic, space group *C*2/*m*, *Cm*, or *C*2. The unit-cell parameters are: a = 5.463(5), b = 15.865(17), c = 10.825(12) Å, β = 93.7(1)°, V = 936 Å^3, Z = 2. The quality of the ferrotochilinite crystals did not allow its structure refinement. The name reflects that ferrotochilinite is a structural analogue (based on chemical, X-ray, and IR data similarities) of tochilinite, with Fe^{2+} instead

* 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-cnmnc/.

of Mg in the hydroxide part. The mineral and the name have been approved by the IMA CNMNC (IMA 2010-080). The type specimen is deposited in Fersman Mineralogical Museum of Russian Academy of Sciences, Moscow. **D.B.**

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Ferrovalleriite*

I.V. Pekov, E.V. Sereda, V.O. Yapaskurt, Yu.S. Polekhovsky, S.N. Britvin, and N.V. Chukanov (2012) Ferrovalleriite, 2(Fe,Cu)S·1.5Fe(OH)$_2$: validation as a mineral species and the new data. Zap. Ross. Mineral. Obshch., 141(6), 29–43 (in Russian, English abstract).

Ferrovalleriite, ideally 2(Fe,Cu)S·1.5Fe(OH)$_2$, a layered hydroxide-sulfide of the valleriite group, the analogue of valleriite with Fe dominance over Mg in the hydroxide part, has been approved along with its name by the IMA CNMNC (IMA 2011-068) as a valid mineral species. The mineral was mentioned repeatedly from the different Cu-Ni-PGM deposits of the Norilsk region, Krasnoyarskiy Kray, Siberia, Russia, under the names: "valleriite-type mineral" (Harris et al. 1970), "Fe-valleriite" (Emelina et al. 1982; Organova 1989), "ferroan valleriite" (Spiridonov and Gritsenko 2009). However, it was never submitted to the IMA CNMNC and the mineral was mentioned as UM1970-24-S:CuFe at the IMA CNMNC list of valid unnamed minerals (update 2012-01).

The complex study of this mineral on the specimens from three different associations (all thought to be of low-temperature hydrothermal origin) at the Oktyabr'skiy Mine, Talnakh, Norilsk area, was undertaken to validate the status of the mineral species. The ferrovalleriite holotype specimen was found in cavities and fractures of the pentlandite-mooihoekite-cubanite ore with minor magnetite and chalcopyrite. It overgrows, along with small octahedral magnetite crystals, the platy crystals of Fe-rich chlorite-type phyllosilicate that incrusts the cavities. Hexagonal plates of ferrovalleriite (up to 0.3 × 2 mm) are overgrown by another recently discovered hydroxide-sulfide, ferrotochilinite. The second association in the less then 1 cm cavities in mooihoekite-cubanite ore with magnetite includes small rhodochrosite crystals. Mn-bearing ferrovalleriite forms here aggregates of thin distorted or curved flakes (up to 0.1 × 2 mm), which fill up to half of the cavities' volume. In fractures of the same ore, where ferrovalleriite is associated with Fe-rich chlorite, hibbingite, and rust-colored lepidocrocite pseudomorphs (presumably after ferrotochilinite), the mineral forms hexagonal or round plates (up to 0.2 × 5 mm) split similar to hematite "roses" or chaotic open aggregates and crusts up to 2 cm in size. In all cases, the main habit form is {001}. When fresh, the mineral is dark bronze-colored, metallic, with a black streak. It rather soon turns nearly black, dull or tarnishes to iridescent or golden-brown. The Mohs hardness is about 1; VHN$_{10}$ = 35 (29–39) kg/mm^2. Cleavage by (001) is mica-like perfect. Individuals are flexible, inelastic. The density could not be measured; D_{calc} = 3.72 g/cm^3. In reflected light, ferrotochilinite is pleochroic with color change from yellowish to gray; bireflectance is moderate (ΔR = 7.6% at 589 nm). Anisotropy is strong, with bluish gray to yellowish beige rotation colors. No internal reflections were observed. Reflectance values were measured between 400 and 700 nm in 20 nm intervals. The values for (COM) wavelengths [R_1, R_2% (nm)] are: 15.0, 16.6 (470); 14.8, 20.5 (546); 14.7, 22.3 (589); 14.5, 24.1 (650). IR spectrum was obtained using a FTIR spectrometer with 4 cm^{-1} resolution. It is similar to those of tochilinite and ferrotochilinite. IR absorption bands (cm^{-1}) are: 3537 (stretching vibrations O – H), 1022weak (stretching vibrations Si–O of an admixed chlorite-type mineral), 708 (bending vibrations $Fe^{2+}\cdots$O–H), 580 (resonance mode of the stretching and bending vibrations of $Fe^{2+}\cdots$O and $Fe^{2+}\cdots$O–H, respectively), 481 (stretching vibrations $Fe^{2+}\cdots$O). No bands due to H_2O molecules were observed. The difference of IR spectra of sulfide-hydroxides and Fe-Cu sulfides with H_2O molecules is discussed. The average of 6 microprobe (EDS and WDS) analyses of the holotype specimen [wt% (range)] is: Al 0.10 (0–0.2), Mn 0.03 (0–0.10), Fe 45.31 (44.1–46.8), Ni 0.07 (0–0.2), Cu 18.29 (17.0–19.4), S 20.37 (19.2–21.8), O 15.62 (14.7–16.8), H_{calc}0.98, total 100.77. The empirical formula calculated on the basis of 2 S atoms, is $Al_{0.01}Fe_{2.55}Cu_{0.91}S_2(OH)_{3.07} = (Fe_{1.09},Cu_{0.91})_{\Sigma 2.00}S_2\cdot(Fe^{2+}_{1.34}Fe^{3+}_{0.12}Al_{0.01})_{\Sigma 1.47}(OH)_{3.07}$. The Fe^{2+}/Fe^{3+} ratio was calculated based on charge balance. Single-crystal X-ray diffraction pattern shows that the mineral is metrically hexagonal with unit-cell parameters a = 3.829(3), c = 33.5(1) Å, V = 425 Å^3, Z = 3. Space group is $R\bar{3}m$, $R3m$, or $R32$. The quality of the ferrovalleriite crystals did not allow its structure refinement. The structure of ferrovalleriite was described as incommensurate (Organova 1989), two sub-lattices are present: (1) "sulfide sub-lattice", with space group $R\bar{3}m$, $R3m$, or $R32$; unit-cell parameters: a = 3.792(2), c = 34.06(3) Å, V = 424 Å^3, and (2) "hydroxide sub-lattice", with space group $P\bar{3}m$l, $P3m1$, or $P321$; parameters: a = 3.202(3), c = 11.35(2) Å, V = 100.8 Å^3. Along with aforementioned main polytype with three-layered (R-cell, Z = 3) sulfide block, the holotype ferrovalleriite contains the modification with one-layer (P-cell, Z = 1) sulfide block [sulfide sub-lattice with space group $P\bar{3}m1$, $P3m1$, or $P321$], parameters are: a = 3.789(4), c = 11.35(1) Å, V = 141(5) Å^3. Powder X-ray diffraction data were obtained using a single-crystal diffractometer by Gandolfi method (Mo$K\alpha$ radiation). The strongest lines of the powder diffraction pattern [d_{obs} (Å) (I_{obs}%; hkl_1, $\boldsymbol{hkl_2}$, hkl_3)] are: 11.42 (18; 003, **001**, 001P), 5.69 (100; 006, **002**, 002P), 3.784 (17; 009, **003**, 003P), 3.268 (58; 101, –, 100P), 3.163 (36; –, –, 101P), 2.765 (14; –, **100**, –), 2.473 (15; –, **012**, 103P), 2.143 (19; –, –, 104P), 1.894 (34; 110, **006**, 006P), 1.871 (113; –, 111P), where hkl_1, $\boldsymbol{hkl_2}$ are related to sub-lattices for sulfide and hydroxide layers, respectively, and hkl_3 to the minor presence of P-cell polytype, which is also known for valleriite. It is suggested to write the chemical formula for valleriite as 2(Fe,Cu)S·1.5[$(Mg_{1-x}Al_x)(OH)_{2+x}$] to keep Z an integral number. The data on Fe-Mg-Al-Mn isomorphism in brucite-like structure modules of the valleriite-group minerals are discussed as well as geochemical and crystallochemical reasons for the rarity in nature of Fe (over Mg) sulfide-hydroxides. The fragment of one of the cotype specimens is deposited in the Fersman Mineralogical Museum of Russian Academy of Sciences, Moscow, Russia. **D.B.**

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Fluoro-Potassic-Pargasite*

R. Oberti, M. Boiocchi, F.C. Hawthorne, R. Pagano, and A. Pagano (2010) Fluoro-potassic-pargasite, $KCa_2(Mg_4Al)(Si_6Al_2)O_{22}F_2$, from the Tranomaro area, Madagascar: mineral description and crystal chemistry. Mineralogical Magazine, 74(6), 961–967.

Fluoro-potassic-pargasite (IMA 2009-091), ideally ${}^{A}K{}^{B}Ca_2{}^{C}(Mg_4Al)^{T}(Si_6Al_2)O_{22}{}^{W}F_2$, is a new amphibole species found in a skarn in the Tranomaro area, Fort Dauphin region, Madgascar. Fluoro-potassic-pargasite occurs in millimetric/centimetric crystals associated with diopside, phlogopite, apatite, calcite, anhydrite, and titanite. Crystals are brittle, with Mohs hardness of 6.5 and a splintery fracture, perfect {110} cleavage, and no observable parting. Fluoro-potassic-pargasite is brownish-black vitreous with a pale-gray streak and is non-fluorescent under UV radiation. Its measured and calculated densities are 3.46 and 3.151 g/cm^3, respectively. In plane-polarized light it is pleochroic, X = colorless to very pale gray, Y = very pale gray, Z = colorless; $X \wedge a = 46.9°$ (in β obtuse), $Y \parallel b$, $Z \wedge c = 31.4°$ (in β acute). It is biaxial positive, with $\alpha = 1.638(2)$, $\beta = 1.641(2)$, $\gamma = 1.653(2)$; $2V_{obs} = 49.6(4)°$, $2V_{calc} = 53.4°$. Electron microprobe analysis (WDS), yielded the following average composition: SiO_2 40.20, Al_2O_3 17.61, TiO_2 0.46, FeO 1.96, and Fe_2O_3 2.51 (FeO:Fe_2O_3 ratio calculated from single-crystal structure refinement), MgO 16.95, MnO 0.05, CaO 13.18, Na_2O 0.99, K_2O 3.72, F 2.75(13), H_2O 0.77 (calculated on the basis of (OH+F) = 2 apfu), total 99.99 wt%. The formula unit, calculated on the basis of 24(O,OH,F) with (OH + F) = 2, is: ${}^{A}(K_{0.69}Na_{0.28}Ca_{0.04})_{\Sigma 1.01}{}^{B}Ca_{2.00}{}^{C}(Mg_{3.64}Fe^{2+}_{0.24}Mn_{0.01}Al_{0.79}Fe^{3+}_{0.27}Ti_{0.05})_{\Sigma 5.00}{}^{T}(Si_{5.80}Al_{2.20})_{\Sigma 8.00}O_{22}{}^{W}[F_{1.26}(OH)_{0.74}]_{\Sigma 2.00}$. The eight strongest lines in the X-ray powder diffraction pattern (Philips PW1800 diffractometer, graphite-monochromatized Cu$K\alpha$ radiation) are [d in Å (I_{obs} %; hkl)]: 3.133 (100; 310), 3.270 (55; 240), 2.809 (47; 330), 8.413 (45; 110), 2.698 (39; 151), 3.374 (31; 131), 2.934 (29; 221), and 1.647 (29; 461). The refined unit-cell parameters, based on the power diffraction pattern, are: a = 9.911(3), b = 17.972(3), c = 5.322(2) Å, β = 105.55(2)°, V = 913.2(4) Å^3, space group $C2/m$, Z = 2. The single-crystal structure refinement of fluoro-potassic-pargasite was performed on the basis of intensity data collected with a Philips PW1100 4-circle diffractometer (graphite-monochromated Mo$K\alpha$ radiation), to R_{all} = 0.024 and 2078 unique reflections. Refined unit-cell parameters based on the single-crystal diffraction pattern are: a = 9.9104(2), b = 17.9739(4), c = 5.3205(1) Å, β = 105.534(2)°, V = 913.11(6) Å^3. The holotype sample of fluoro-potassic-pargasite was obtained from the mineral collection of Renato and Adriana Pagano (Cinisello, Milan, Italy), where it is specimen no. 7074B. Fragments of the holotype specimen are deposited at the Museo di Mineralogia of the Dipartimento di Scienze della Terra of the University of Pavia with the code 2009-02. **G.D.G. and F.C.**

Guidottiite*

M.W. Wahle, T.J. Bujnowski, S. Guggenheim, and T. Kogure (2010) Guidottiite, the Mn-analogue of cronstedtite: A new serpentine-group mineral from South Africa. Clays and Clay Minerals, 58(3), 364–376.

Guidottiite (IMA 2009-061), ideally $(Mn_2Fe^{3+})(SiFe^{3+})O_5(OH)_4$, is a new serpentine-group mineral found in the N'chwaning 2 mine, Kalahari manganese field, Republic of South Africa. The mineral appears to form from hydrothermal solutions, and occurs with hematite, chlorite, leucophoenicite, caryopilite, barite, rhodochrosite, shigaite, and gageite. Guidottiite is analogous to cronstedtite [i.e., an Fe-rich trioctahedral 1:1 layer silicate of the serpentine group with an ideal end-member formula $(Fe^{2+}_2Fe^{3+})(SiFe^{3+})O_5(OH)_4$]. Crystallites of guidottiite, ranging in size up to ~3 mm, are vitreous and black, with perfect {001} platy cleavage. They are optically near opaque, with average refraction index of 1.765 and variable extinction on the (001). The Mohs hardness is about 4. The calculated density is 3.236–3.291 g/cm^3 (on the basis of a slightly different compositions), the measured density is 3.33 g/cm^3. Electron microprobe analyses (EDS), yielded the average composition (in wt%): MgO 5.65±0.79, MnO 34.21±0.84, Fe_2O_3 25.97±0.22, SiO_2 21.23±0.44, total 87.06 wt%, corresponding to the empirical formula (determined anhydrously, based on seven oxygen atoms): $(Mn_{1.86}Fe^{3+}_{0.61}Mg_{0.54})_{\Sigma=3.01}(Si_{1.36}Fe^{3+}_{0.64})_{\Sigma=2.00}O_5(OH)_4$. Thermal analysis suggested a dehydroxylation temperature of 535 °C, a decomposition/re-crystallization temperature of 722 °C, and weight loss (= H_2O loss) of 9.4%. Transmission electron microscope analysis was performed and HRTEM images showed stacking disorder within Group D serpentine polytypes (i.e., with a regular alternation of the occupancy of octahedral sets within each layer along the stacking, but affected by disorder of the layer displacements of 0 and ±b/3, where b is referred to the orthohexagonal cell). Crystals of guidottiite from N'chwaning 2 show mostly the $2H_1$ polytype (i.e., ordered, no layer displacement), with minor amounts of the $2H_2$ polytype (i.e., with alternating + and –b/3 displacement). The six strongest observed X–ray powder diffraction lines (Gandolfi camera, graphite-monochromatized Mo$K\alpha$ radiation) are [d in Å (I_{obs} %; hkl)]: 7.21 (100; 002), 3.543 (50; 004), 2.568 (39; 112), 1.982 (26; 115), 2.381 (25; 113, 006), 2.706 (14; 111). The powder diffraction pattern was indexed on the basis of single-crystal X-ray diffraction data (Bruker diffractometer, monochromatized Mo$K\alpha$ radiation), with the following unit-cell parameters: a = 5.5472(3) and c = 14.296(2) Å, with a metrically hexagonal lattice (Z = 2). The reflection conditions suggested the space group $P6_3$. The single-crystal structure refinement was performed on the basis of intensity data collected from a well (stacking) ordered apparent $2H_2$ crystal (i.e., with little to no streaking in the diffraction pattern). The refined converged to R_1 = 0.072 and wR_2 = 0.108 from 656 unique reflections [$I > 3\sigma(I)$]. Results showed that the crystal actually has a random interstratification of $2H_2$ and $2H_1$.

The mineral name honors Charles V. Guidotti (1935–2005) of the University of Maine, U.S.A., for his many contributions

to phyllosilicate mineralogy. A specimen of guidottiite (NMNH 174879) has been deposited in the Smithsonian Institution, Washington, D.C., U.S.A. **G.D.G. and F.C.**

HYDROXYLCHONDRODITE*

I.V. Pekov, E.I. Gerasimova, N.V. Chukanov, Y.K. Kabalov, N.V. Zubkova, A.E. Zadov, V.O. Yapaskurt, V.M. Gekimyants, and D.Y. Pushcharovskii (2011) Hydroxylchondrodite $Mg_5(SiO_4)_2(OH)_2$: A new mineral of the humite group and its crystal structure. Doklady Akademii Nauk, 436(4), 526–532 (in Russian). English translation: Doklady Earth Sciences, 2011, 436(2), 230–236.

A new member of humite group, OH analogue of chondrodite, hydroxylchondrodite, ideally $Mg_5(SiO_4)_2(OH)_2$, has been discovered in the Perovskitovaya Kop' (perovskite pit) on the western slope of the Chuvashskie Mountains in the Zlatoust region, South Urals, Russia. It was found in the contact zone between magnesium skarn and host marble in calcite-clinochlore aggregates with dolomite, tremolite, diopside, andradite–grossular, magnetite, perovskite, hydroxylclinohumite, and titanite. Hydroxylchonrodite forms coarse tabular or lens-like individuals up to 0.5 × 1.5 × 1.5 cm and their intergrowths up to 2 cm. The mineral is reddish-brown, vitreous, with a pale-yellow streak. The Mohs hardness is 6. Hydroxylchondrodite is brittle, fracture is uneven and cleavage is not observed. Parting by {001} is due to thin polysynthetic twinning. The measured density is 3.21 (1), D_{calc} = 3.183 g/cm^3. The mineral is optically biaxial (+), α = 1.662(3), β = 1.669(2), γ = 1.688(2), $2V_{meas}$ = 80(10)°, $2V_{calc}$ = 63°; $Z = b$. It is strongly pleochroic: X = brown; Y = light brown with grayish green tint; Z = pale, grayish greenish brown; $X > Y > Z$. The IR spectrum noticeably differs from that of chondrodite. The main absorption bands (cm^{-1}, w = weak, sh = shoulder) are: 3555w, 3512w, 3377 (O–H stretching vibrations); 1080sh, 1020sh, 993, 901, 853, 830sh (Si–O stretching vibrations); 779w, 738 (O–Si–O and Mg···O–H bending vibrations); 614, 541, 476, 445sh, 416 (O–Si–O bending and Mg–O stretching vibrations). The average of 11 microprobe analyses (EDS and WDS) is [wt% (range)]: MgO 52.74 (52.2–54.3); FeO 1.51 (1.3–1.7); TiO_2 7.08 (6.8–7.2), SiO_2 34.38 (34.2–35.2), P_2O_5 0.47 (0.4–0.6); F 1.29 (1.1–1.5); H_2O 3.48 (by the Alimarin method), –O=F_2 –0.54; total 100.41. Other elements with atomic numbers exceeding that of O were not detected. The empirical formula calculated for (O+OH+F) = 10 is $(Mg_{4.52}Ti_{0.31}Fe_{0.07})_{\Sigma 4.90}(Si_{1.98}P_{0.02})_{\Sigma 2.00}O_8[(OH)_{1.33}O_{0.44}F_{0.23}]_{\Sigma 2.00}$. Finds of chondrodite with low to near zero F content were previously mentioned without its complete description in similar to Perovskitovaya Kop' assosiation at Bol'shaya Shishimskaya Kop' of the same Zlatoust region, South Ural, Russia (Borneman-Starynkevich 1964), in kimberlite of the Buell Park, Arizona, U.S.A. (Aoki et al. 1976) and in garnet pyroxenite from Dabie Shan, China (Hermann et al. 2007). In all those localities the mineral was enriched with Ti. Powder X-ray diffraction data were obtained using a single-crystal diffractometer by Gandolfi method (Mo$K\alpha$ radiation). The strongest lines of the powder diffraction pattern [d_{obs} (Å) (I_{obs}%, hkl)] are: 4.87 (24, 10$\bar{2}$), 3.568 (26, 102, 20$\bar{2}$), 3.479 (26, 111), 3.023 (36, 21$\bar{1}$), 2.763 (37, 11$\bar{3}$), 2.673 (37, 013), 2.621 (44, 211), 2.518 (59, 21$\bar{3}$), 2.293 (35, 021, 31$\bar{1}$), 2.260 (74, 31$\bar{2}$, 212, 11$\bar{4}$), 1.740 (100, 32$\bar{2}$, 222, 12$\bar{4}$). The refined parameters of the monoclinic cell are: a = 7.8847(12), b = 4.7235(8), c = 10.2869(15) Å, β = 109.19(1)°, V = 361.83(16) Å^3. The space group is $P2_1/c$, Z = 2. Polysynthetic twinning and blocky character of crystals did not allow refining the crystal structure to a satisfactory value of the R factor using a single crystal. The structure of hydroxylchondrodite was confirmed by the Rietveld method using the model of its synthetic analog structure as the starting model. Hydroxylchondrodite is isostructural with chondrodite and differs from the latter by the OH predominance in the F site. Based on similarity to synthetic analogue and IR data, it is suggested that in hydroxylchondrodite H atoms occupy two positions and probably form bifurcated hydrogen bonds. The mineral and its name were approved by the IMA CNMNC (IMA 2010-019). The type specimen is deposited in the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. **D.B.**

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HYDROXYMANGANOPYROCHLORE*

N.V. Chukanov, G. Blass, N.V. Zubkova, I.V. Pekov, D.Y. Pushcharovskii, and H. Prinz (2013) Hydroxymanganopyrochlore: A New Mineral from the Eifel Volcanic Region, Germany. Doklady Akademii Nauk, 449(2), 215–218. English translation: Doklady Earth Sciences, 2013, 449(1), 342–345.

A new member of pyrochlore supergroup ($A_2B_2X_6Y$), hydroxymanganopyrochlore, with Mn^{2+} dominance in A site and OH dominance in Y site, has been discovered in an active pumice quarry In den Dellen near the city of Mendig, Laacher See area, Eifel volcanic region, Rheinland-Pfalz, Germany. The mineral was found in small miarolitic cavities in sanidinite in a late pneumatolytic association that includes sanidine, nosean, biotite, tephroite, jacobsite, and spinellides of the gahnite–hercynite series. Hydroxymanganopyrochlore forms dark-brown or black with red reflexes perfect octahedral crystals, up to 0.7 mm. The mineral is brittle with no cleavage. The calculated density is 5.398 g/cm^3 and calculated refractive index is 2.29. The main absorption bands of IR spectrum (cm^{-1}, sh = shoulder) are: 3290 (O–H stretching vibrations), 960sh, 870sh, (bending vibrations A···O–H, B···O–H), 720sh, 569, 420 (vibrations of octahedral framework). No bands due to B and C containing groups or H_2O molecules were detected. The average of 7 microprobe analyses (EDS) is [wt% (range)]: Na_2O 2.48 (2.19–2.75), CaO 3.65 (3.51–3.77), MnO 8.22 (7.95–8.43), Fe_2O_3 3.39 (2.75–3.89), La_2O_3 3.22 (2.77–3.49), Ce_2O_3 6.76 (6.23–7.37), Nd_2O_3 0.92 (0.67–1.15), TiO_2 15.43 (14.70–15.96), ThO_2 22.58 (21.60–23.77), UO_2 2.42 (1.69–3.27), Nb_2O_5 29.42 (28.92–30.63), F 0.49 (0.39–0.62); H_2O (calculated by charge balance) 1.34, –O=F_2 –0.21; total 100.11. The empirical formula of hydroxymanganopyrochlore calculated for (O+OH+F) = 7 is: $(Mn_{0.51}Th_{0.37}Na_{0.35}Ca_{0.29}$

$Ce_{0.18}La_{0.09}Nd_{0.02}U_{0.04})_{\Sigma 1.85}(Nb_{0.97}Ti_{0.85})_{\Sigma 2.01}O_6[(OH)_{0.65}O_{0.24}F_{0.11}]$. The simplified formula is $(Mn^{2+},Th,Na,REE)_2(Nb,Ti)_2O_6(OH)$. Powder X-ray diffraction data were obtained by Gandolfi method (Mo*K*α radiation) using a single-crystal diffractometer. The strongest lines of the powder diffraction pattern [d_{obs} (Å) (I_{obs}%, *hkl*)] are: 2.969 (100, 222), 2.569 (40, 400), 2.358 (12, 331), 1.816 (47, 440), 1.548 (40, 622), 1.481 (14, 444), 1.178 (14, 622). The parameter of cubic unit-cell is: $a = 10.2523(2)$ Å, $V = 1077.62(4)$ Å^3, $Z = 8$. The crystal structure solved by direct methods within the space group $Fd\bar{3}m$ and refined to $R = 0.0414$ for 91 reflections with $I > 2\sigma(I)$. The hydroxymanganopyrochlore structure is similar to those of other pyrochlore supergroup members. According to the data obtained, Mn is the predominant element in the A site and Nb in the B site. The mineral was named for its composition in accordance with current nomenclature of pyrochlore supergroup. Both the mineral and the name were approved by the IMA CNMNC (IMA 2012-005). The type specimen is deposited in the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. **D.B.**

Lahnsteinite*

N.V. Chukanov, R.K. Rastsvetaeva, S.M. Aksenov, I.V. Pekov, D.I. Belakovskiy, G. Blass, and G. Mohn (2013) Lahnsteinite, $Zn_4(SO_4)(OH)_6 \cdot 3H_2O$, a new mineral species from the Friederichssegen Mine, Germany. Zap. Ross. Mineral. Obshch., 142(1), 39–46 (in Russian, English abstract).

R.K. Rastsvetaeva, S.M. Aksenov, N.V. Chukanov, and I.A. Verin (2012) Crystal structure of a new mineral lahnsteinite $Zn_4(SO_4)(OH)_6 \cdot 3H_2O$. Kristallografiya, 57, 5, 825–829 (in Russian). English translation: Crystallography Reports (2012), 57(5) 737–741.

A new mineral lahnsteinite was discovered at the dump of the Friedrichssegen Mine, near the city of Lahnstein in the Lahn valley, Ems District, Rhineland-Palatinate (Rheinland-Pfalz), Germany. It formed in the oxidation zone of a complex (Pb, Zn, Cu, Ag, Fe) deposit, where the ore is related to quartz-siderite veins that are crosscut Devonian schist. The mineral occurs in the cavities in goethite, and is associated with hydrozincite, pyromorphite, and native copper. Perroudite, native silver, I- and Cl-bearing Hg and Ag sulfides (under study) were found in similar cavities in goetite. Lahnsteinite forms hexagonal tabular crystals up to 0.15 × 0.5 × 0.5 mm. Besides the main forms {001} and {00$\bar{1}$}, other forms are: {110}, {130}, {010}, {$\bar{1}\bar{1}$0}, {$\bar{1}\bar{3}$0}, and {0$\bar{1}$0}. The mineral has mica-like cleavage by (001) and less perfect cleavage in two directions almost perpendicular to (001). Cleavage flakes are sectile. The Mohs hardness is 1.5. $D_{calc} = 2.995$, $D_{meas} = 2.98(2)$ g/cm^3. Lahnsteinite is optically biaxial (–), $\alpha = 1.568(2)$, $\beta = 1.612(2)$, $\gamma = 1.613(2)$, $2V_{meas} = 18(3)°$, $2V_{calc} = 17°$; $X \sim c$, $Y \sim b$, $Z \sim a$. The main absorption bands of IR spectrum (cm^{-1}, s = strong, sh = shoulder) are: 3500sh, 3445s, 3375sh, 3250sh (O-H stretching vibrations), 1637 (bending vibration of H_2O), 1158s, 1118s, 1060, 1032, 971 (S-O stretching vibrations of SO_4^{2-} anions), 901, 808, 780, 701 (bending vibrations Zn···O-H), 600s (O-S-O bending vibrations of SO_4^{2-} anions), 516, 415 (superposition of lattice and libration modes of Zn-O and H_2O molecules, respectively). The bands related to B or C bearing groups are absent in IR spectrum. The average (range) of six microprobe analyses (H_2O by gas chromatography of ignition products at 1200 °C) is: FeO 3.87 (3.12–4.57), CuO 1.68 (1.35–1.90), ZnO 57.85 (56.44–59.54), SO_3 15.83 (15.40–16.33), H_2O 22.3, total 101.53 wt%. The empirical formula based on 13 O is $(Zn_{3.53}Fe_{0.27}Cu_{0.11})_{\Sigma 3.91}(S_{0.98}O_4)(OH)_6 \cdot 3H_{2.10}O$; the idealized formula is $Zn_4(SO_4)(OH)_6 \cdot 3H_2O$. Powder X-ray diffraction data were obtained by Gandolfi method using single-crystal diffractometer (Mo*K*α radiation). The strongest lines of the powder diffraction pattern [d_{obs} (Å) (I_{obs}%, *hkl*)] are: 9.30 (100, 002), 4.175 (18, 200), 3.476 (19, 133), 3.290 (19, 1$\bar{1}$5), 2.723 (57, 240), 2.624 (36, 242), 2.503 (35, $\bar{1}$53), 1.574 (23, 191). The triclinic (pseudo-orthorhombic) unit-cell parameters are: $a = 8.35(3)$, $b = 14.48(4)$, $c = 18.60(6)$ Å, $\alpha = 89.4(2)$, $\beta = 90.2(1)$, $\gamma = 90.6(2)°$. The crystal structure was solved by direct methods and refined to R_1 10.7% using 3788 reflections with $|F_o| > 3\sigma(F_o)$. The single-crystal unit-cell parameters are: $a = 8.3125(6)$, $b = 14.545(1)$, $c = 18.504(2)$ Å, $\alpha = 89.71(1)$, $\beta = 90\ 05(1)$, $\gamma = 90\ 13(1)°$, $V = 2231.2(3)$ Å^3, and $Z = 8$. The lahnsteinite crystal structure is based on brucite-like sheets consisting of edge-sharing Zn octahedra, in six-membered rings with vacant central octahedra. Zn and S tetrahedra are attached to both sides of the octahedral sheet, with S tetrahedra sharing an apex with Zn octahedra while Zn tetrahedra are attached at both sides of the vacant central octahedral. Chemically and topologically identical and electrically neutral sheets are displaced relative to each other by ½ *a,* and linked only by the hydrogen bonds of water molecules. The distribution of H_2O groups in the space between the sheets is disordered. Linkage by weak hydrogen bonds leads to packing defects in the sheet sequence, which explains large R_1 factor while the structure model is consistent in the cationic composition, thermal parameters, interatomic distances, and bond-balance sum on anions. The crystallochemical formula of lahnsteinite is $[^{VI}(Zn,Fe,Cu)_3(OH)_3][^{IV}Zn(OH)_3(H_2O)][SO_4](H_2O)_2$ where the layers of Zn octahedra and isolated Zn and S centered tetrahedra are given in square brackets. The mineral is almost identical to the synthetic zinc hydroxide sulfate trihydrate $3Zn(OH)_2 \cdot ZnSO_4 \cdot 3H_2O$ (space group $P\bar{1}$) and is chemically and structurally similar to namuwite $(Zn,Cu)_4(SO_4)(OH)_6 \cdot 4H_2O$ (which does not have sheets displacement in its structure) and osakaite $(Zn,Cu)_4(SO_4)(OH)_6 \cdot 5H_2O$. It is also structurally related to schulenbergite, ktenasite, christelite, and gordaite. The mineral was named after the city of Lahnstein near the type locality. Both the mineral and its name have been approved by the IMA CNMNC (IMA 2012-002). Type specimen is deposited in the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia. **D.B.**

Mariinskite*

L.A. Pautov, M.P. Popov, Y.V. Erokhin, V.V. Khiller, and V.Y. Karpenko (2012) Mariinskite, $BeCr_2O_4$, a new mineral, chromium analogue of chrysoberyl. Zap. Ross. Mineral. Obshch., 141(6), 43–62 (in Russian, English abstract).

A new mineral mariinskite, ideally $BeCr_2O_4$, the chromium analogue of chrysoberyl, has been discovered at the Mariinskoye (Malyshevskoe) Be deposit, Ural Emerald Mines, Middle Urals, Russia, and named for its type locality. That locality is also famous as an important emerald deposit and type locality of alexandrite, a

Cr-bearing color change variety of chrysoberyl. The new mineral was found in the chromitite lens in serpentinites. Chromitite rocks consist of brown to black Al-rich chromite I grains, randomly distributed in the matrix of brown, grainy aggregates of chromite II (with low-Al content), which replaces chromite I. Chromite rocks are crosscut by randomly oriented veinlets containing greenish-gray fluorophlogopite and bluish-green Cr-muscovite. Mariinskite forms isometric anhedral grains less then 1mm in chromite II. Less common are euhedral zonal grains or pseudohexagonal chrysoberyl-type twins. Mariinskite often contains inclusions of fluorophlogopite and eskolaite and is associated with zonal tourmaline of dravite-fluordravite composition. The origin of the new mineral is thought to be metasomatic. Mariinskite is dark green, vitreous, with a pale green streak. The fracture is conchoidal. The Mohs hardness is 8.5; VHN_{150} = 1725 (1681–1771) kg/mm^2. D_{meas} = 4.25(2), D_{calc} = 4.25 g/cm^3. No fluorescence under UV light or electron beam was observed. In transmitted light, the mineral is emerald-green, strongly pleochroic: Z = emerald-green, Y = yellow-green, X = greenish-yellow; $Z > Y > X$. Mariinskite is optically biaxial (+); α = 2.05 (1), β = 2.09 (3), γ = 2.15 (1), $2V$ = 80° (10), $2V_{calc}$ = 80.5°. The absorption spectrum in the visible range shows wide absorption bands with maximums at 430 and 620 nm for Z, 435 and 600 nm for X (typical for coloration related to Cr^{3+}). The maximums are shifted to the higher nm values, compare to alexandrite studied under the same conditions. That causes the absence of an alexandrite effect. In reflected light, mariinskite is gray with very weak bluish hue and green internal reflections. The mineral has very weak bireflectance. Anisotropy is weak without color effects. Reflectance values were measured between 400 and 700 nm. R_{min} and R_{max} varies from 12 to 16% with a weak maximum at 400 nm. R_{min} (589 nm) = 12.3, R_{max} (589 nm) = 12.9%. The strongest IR absorption bands (cm^{-1}) are: 935, 700 (stretching vibrations of BeO_4 tetrahedra), 614, 534 [stretching vibrations of $(Cr,Al)O_6$ octahedra]. The average of 92 microprobe (EDS and WDS) analyses [wt% (range)] is: BeO 16.3 (15.4–17.2), Al_2O_3 23.89 (15.24–29.73), Cr_2O_3 58.67 (52.99–65.39), Fe_2O_3 0.26 (0.11–0.40), V_2O_3 0.26 (0.10–0.39), TiO_2 0.61 (0.08–1.80), total 99.98. The empirical formula, calculated on the basis of 4 O, is $Be_{1.03}(Cr_{1.22}Al_{0.74}Ti_{0.01}Fe_{0.01}V_{0.01})_{\Sigma 1.99}O_4$. X-ray powder diffraction data were obtained using Debye-Scherrer and Guinier cameras (Cu$K\alpha$ filtered radiation). The strongest lines of the powder diffraction pattern [d_{obs} (Å) (I_{obs}%, hkl)] are: 4.08 (40, 101), 3.31 (90, 111), 2.629 (50, 301), 2.434 (50, 220), 2.381 (40, 311), 2.139 (60, 401), 1.651 (100, 222). Mariinskite is orthorhombic, space group *Pnma.* The unit-cell parameters are: a = 9.727(3), b = 5.619(1), c = 4.499(1) Å, V = 245.9 Å^3, Z = 4. No crystal suitable for crystal structure refinement was found. By the X-ray data, optical, and other physical properties, mariinskite is identical to synthetic $BeCr_2O_4$ for which structure is known. The mineral and its name were approved by the IMA CNMNC (IMA 2011-057). The type specimens are deposited in the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, and in the Ural Geological Museum, Ekaterinburg, Russia. **D.B.**

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