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New Mineral Names

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Abstract

This issue of New Mineral Names provides a summary of several new species in the tetrahedrite-group along with examples of how museums are sharing type and cotype specimens. Currently there are approximately 50 sulfosalt mineral species in the tetrahedrite-group that have the general formula $^{M2}(\mathbf{A}_6)^{M1}(\mathbf{B}_4\mathbf{C}_2)^{X3}(\mathbf{D}_4)^{S1}(\mathbf{Y}_{12})^{S2}(\mathbf{Z})$, with **A** = Cu^+, Ag^+, □; **B** = Cu^+, Ag^+; **C** = Zn^{2+}, Fe^{2+}, Hg^{2+}, Cd^{2+}, Mn^{2+}, Ni^{2+}, Cu^{2+}, Cu^+, Fe^{3+}; **D** = Sb^{3+}, As^{3+}, Bi^{3+}, Te^{4+}; **Y** = S^{2-}, Se^{2-}; **Z** = S^{2-}, Se^{2-}, □. All members if the tetrahedrite-group are isometric and have potential applications high efficiency thermoelectric materials. Some the type specimens of tetrahedrite, and others in this review, are shared between museums. Having newly described minerals housed at multiple museums provides easier access to specimens for researchers around the world and serves to preserve these minerals in case of loss at any one the institutions. Here we look at the descriptions of stibiogoldfieldite, graulichite-(La), tennantite-(Cu), wildcatite, ellinaite, paqueite, burnettite, saccoite, and gurzhiite.

Stibiogoldfieldite

Stibiogoldfieldite (Biagioni et al. 2022c), ideally $Cu_{12}(Sb_2Te_2)S_{13}$, is related to goldfieldite but is the Sb end-member of the tetrahedrite-group of minerals. (See Biagioni et al. 2020 for a full description of the tetrahedrite group.) Stibiogoldfieldite was found at the Mohawk Mine, Goldfield mining district, Nevada, U.S.A. The Mohawk Mine was a mineralogically diverse Cu-Ag-As mine and has about 44 different mineral species reported from the area, including mohawkite. Of all the tetrahedrite group minerals, those containing Te are the rarest, and stibiogoldfieldite was found in rocks that were volcanically hydrothermally altered from approximately 30 Mya to 5 Mya. These host rocks have been mined for precious metals gold, silver, copper, tin, zinc, and others.

Stibiogoldfieldite crystallizes in space group $I43m$ with a = 10.3466(17) Å, V = 1107.6(5) Å^3, and has a calculated density of 5.055 g/cm^3. The mineral and its name have been approved by the CNMNC (IMA 2020-093). The type material is deposited in the mineralogical collections of the Museo di Storia Naturale of the University di Pisa, Italy (catalog number 19926), and the Department of Mineralogy and Petrology, National Museum, Prague, Czech Republic (catalog numbers P1P 78/2020 and P1P 80/ 2020).

Graulichite-(La)

Graulichite-(La) (Biagioni et al. 2022a), ideally $LaFe^{3+}_3(AsO_4)_2(OH)_6$, is part of the tetrahedrite-group of minerals and is similar to graulichite-(Ce) (Hatert et al. 2003), but has La as the dominant **D**-site cation. Graulichite-(La) was found in the Patte d'Oil mine, in the Djebel Saghro mountain range, approximately 50 km southeast of Ouarzazate, Morocco.

The crystals of graulichitge-(La) are chemically zoned and were found to have two distinct chemical domains. The structure and composition of each of these domains are La-dominate, but have different densities due to slight variation in site occupancies of extra-framework and framework composition as measured from chemical analysis; domain 1 $(La_{0.34}Ce_{0.20}Ca_{0.11}Sr_{0.07}Pb_{0.05}K_{0.04})_{\Sigma 0.81}(Fe^{3+}_{2.16}Al_{0.84}Cu_{0.20})_{\Sigma 3.20}(As_{1.23}P_{0.39}S_{0.37})_{\Sigma 1.99}O_{14}H_{6.13}$, and domain 2 $(La_{0.38}Ce_{0.22}Sr_{0.10}Ca_{0.09}Pb_{0.05}K_{0.06})_{\Sigma 0.90}(Fe^{3+}_{2.16}Al_{0.49}Cu_{0.20})_{\Sigma 3.29}(As_{0.91}P_{0.50}S_{0.40})_{\Sigma 1.81}O_{14}H_{6.53}$.

Graulichite-(La) crystallizes in space group $R\bar{3}m$ with a = 7.252(13) Å, c = 16.77(3) Å, V = 764(3) Å^3, and has calculated densities of 3.907 and 3.962 g/cm^3 for the two different domains. The mineral and its name have been approved by the CNMNC (IMA 2020-093). The holotype material is deposited in the mineralogical collection of the Museo di Storia Naturale, University of Pisa, Italy (catalog number 19924).

Tennantite-(Cu)

Tennantite-(Cu) (Biagioni et al. 2022b), ideally $Cu_{12}As_4S_{13}$, is the Cu-dominant member of tennantite and is part of the tetrahedrite-group of minerals. The specimen, found in the Layo epithermal deposit of Castilla Province, Peru, was initially described as "Cu-excess tennantite" (Marcoux et al. 1994). Tennantite was first mineral described that eventually became part the tetrahedrite-group, which was named after the English chemist Smithson Tennate (1761–1815). Other species of the tennantite-subgroup include tennantite-(Fe), -(Zn), -(Ni), -(Hg), and -(Cd).

Tennantite-(Cu) crystallizes in space group $I43m$ with a = 10.1710(10) Å, V = 1052.2(2) Å^3, and has calculated density 4.656 g/cm^3. The mineral and its name have been approved by the CNMNC (IMA 2020-096). Parts of the holotype material are deposited in the collections of the Department of Mineralogy and Petrology, National Museum in Prague, Czech Republic (catalog number P1P 74/2020), in the collections of the Museo di Storia Naturale of the Università di Pisa, Italy (catalog number 19925), and at the Mineralogical Museum of Ecole des Mines de Paris (catalog number ENSMP 83990).

Wildcatite

Wildcatite (Missen et al. 2021), ideally $CaFe^{3+}Te^{6+}O_5(OH)$, is the first known mineral (primary or secondary) to contain the elements Ca, Fe, and Te. Wildcatite is named after the Wildcat Prospect (the type locality). This prospect was named after its location in the Wildcat Hills of Utah, which extends north toward Topaz Mountain. The mineral likely formed from late-stage oxidation of the host brecciated sedimentary rocks. According to MinDat.org, the localities with the greatest number of Te species are (in order) the Bambolla Mine (Sonora, Mexico) with 38, Trixie Mine (Utah, U.S.A.) with 27, Kawazu Mine (Shizuoka Prefecture, Japan) with 27, and Kockbulak Mine (Tashkent, Uzbekistan) with 25.

Wildcateite crystallizes in space group $P\bar{3}1m$ with a = 5.2003(14) Å, c = 4.9669(14) Å, V = 116.3(1) Å^3 and has calculated densities of 4.739 g/cm^3 for the empirical formula and 4.557 g/cm^3 for the ideal formula. The mineral and its name have been approved by the CNMNC (IMA 2020-019). The cotype material is deposited in the collections in the Natural History Museum of Los Angeles County with (catalog numbers 74538, 74539, and 74540), Museums Victoria, Melbourne, Australia (catalog numbers M55257 and M55258), the Natural History Museum, London,

* All minerals have been approved by the IMA CNMMC. For a complete listing of all IMA-validated unnamed minerals and their codes, see http://cnmnc.main.jp/ (click on "IMA list of minerals").

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U.K. (catalog number BM 2020,4), and the W.M. Keck Earth Science and Mineral Engineering Museum at the University of Nevada, Reno (catalog number 2020.002.001).

Ellinaite

Ellinaite (Sharygin et al. 2021), ideally $CaCr_2O_4$, is named in honor of Ellina Vladimirovna Sokol (b. 1961) from the Institute of Geology and Mineralogy, Novosibirsk, Russia. Ellina Sokol is a well-known Russian mineralogist and petrologist, who specialized in the studies of pyrometamorphic rocks around the world, including the Hatrurim Formation (Mottled Zone) rocks from where ellinaite was found. Ellinaite is the natural analog of β-$CaCr_2O_4$, which is known as an important component of composite alloy and ceramic materials.

Ellinaite crystallizes in space group *Pnma* with a = 8.868(9) Å, b = 2.885(3) Å, c = 10.355(11) Å, V = 264.9(5) $Å^3$, and has a calculated density of 5.217 g/cm^3. The mineral and the name were approved by the CNMNC (IMA 2019-091). An individual grain of ellinaite was deposited in the collections of the A.E. Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia (catalog number 5439/1). Another grain of ellinaite from in a polished thin section is in the collections of the Central Siberian Geological Museum at V.S. Sobolev Institute of Geology and Mineralogy, Russia (catalog number VII-102/1). The co-type sample of ellinaite from Córigo Sorriso, Mato Grosso State, Brazil (TEM foil from a diamond), is located at the Institute of Geochemistry and Analytical Chemistry, Moscow, Russia.

Paqueite and Burnettite

Paqueite and burnettite (Ma et al. 2022) are calcium aluminum-rich inclusions found in different specimens of Allende-type meteorites. Paqueite, ideally $Ca_3TiSi_2[Al,Ti,Si]_3O_{14}$, is named in honor of Julie Paque (b. 1958), a cosmochemist at the California Institute of Technology. Her work has emphasized analytical and experimental approaches to understanding the name of calcium aluminum-rich inclusions in meteorites. Burnettite, ideally $CaVAlSiO_6$, is named after Donald Burnett (b. 1937), a cosmochemist also at the California Institute of Technology, who has extensively studied nucleosynthesis and the abundance of elements of lunar and meteoritic materials.

The authors detail crystallization sequences and demonstrate that these two minerals likely formed from late-stage melting, and their occurrences may help constrain the thermal history of the rocky bodies during early solar system formation.

Paqueite crystallizes in space group *P*321 with a = 7.943 Å, c = 4.930 Å, V = 269.37 $Å^3$ with a calculated density of 3.39 g/cm^3. Burnettite crystallizes in space group *C*2/*c* with a = 9.80 Å, b = 8.85 Å, c = 5.36 Å, β = 105.6°, V = 447.7 $Å^3$, and has a calculated density of 3.44 g/cm^3. The two new minerals paqueite (IMA 2013-053) and burnettite (IMA 2013-054) have been approved by the CNMNC. Type burnettite occurs in CGft-12, an Allende type A inclusion from the Field Museum of Chicago, Illinois, U.S.A. (catalog number ME2639-23.2), and this specimen also contains paqueite. Type paqueite occurs within a polished section of Allende in the type A CAI A-WP1, which is deposited in the Smithsonian Institution's National Museum of Natural History, Washington, D.C., U.S.A. (catalog number USNM 7617).

Saccoite

Saccoite (Giester et al. 2022), ideally $Ca_2Mn^{3+}_2F(OH)_8{\cdot}0.5(SO_4)$, is named in honor of Guido Sacco (1900–1994) and his son Desmond Scacco (b. 1942). The father and son explored and developed mining in the Postmasburg and Kalahari Manganese Fields of the Northern Cape Province, Republic of South Africa. The mineral was found in the N'Chwaning III underground mine.

The microporous structure of saccoite is built from $CaF_2(OH)_6$ and $Mn(OH)_6$ polyhedra, while pores are filled with SO_4 tetrahedra. All of the OH groups are aligned on the walls of the channels to support the sulfate groups and suggests that the material might behave as an anion exchanger.

Saccoite crystallizes in space group *P*4/*ncc* with a = 12.834(3) Å, c = 5.622(2) Å, V = 960.0(4) $Å^3$, and has a calculated density of 2.73 g/cm^3. The mineral and its name have been approved by the Commission on New Minerals, Nomenclature and Classification (CNMNC) of the International Mineralogical Association (IMA 2019-056). The holotype material is deposited in the mineral collection of the Natural History Museum Vienna, Austria (catalog number O1784).

Gurzhiite

Gurzhiite (Kasatkin et al. 2022), ideally $Al(UO_2)(SO_4)_2F{\cdot}10H_2O$, is named in honor of Vladislav Vladimirovich Gurzhiy (b. 1985), an associate professor in the Department of Crystallography and Chairman of the Scientific Committee at the Institute of Earth Sciences, Saint-Petersburg State University. Dr. Gurzhiy is known for his expertise in uranium mineralogy and crystallography.

The holotype specimen of gurzhiite was found in the Bykogorskoe uranium deposit in Byk Mountain, Northern Caucasus, Russia. This area is confined to a hypabyssal intrusion of granite-porphyry that composes the dome-shaped uplift of Byk Mountain. To date, there are 57 known uranium sulfate minerals, and 37 of those have been described in the last 10 years. The majority of the recent discoveries have come from San Juan County, Utah, U.S.A. (Blue Lizard Mine, Green Lizard Mine, Markey Mine, Burro Mine, and others).

Gurzhiite crystallizes in space group *P*1 with a = 7.193(2) Å, b = 11.760(2) Å, c = 11.792(2) Å, α = 67.20(3)°, β = 107.76(3)°, γ = 89.99(3)°, V = 867.7(4) $Å^3$ with a measured density 2.52(3) g/cm^3 and a calculated density based on the empirical formula of 2.605 g/cm^3. The new mineral and its name have been approved by the CNMNC (IMA2021-086). The holotype specimen is deposited in the collections of the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia (catalog number 5756/1).

References cited

Biagioni, C., George, L.L., Cook, N.J., Makovicky, E., Moëlo, Y., Pasero, M., Sejkora, J., Stanley, C.J., Welch, M.D., and Bosi, F. (2020) The tetrahedrite group: Nomenclature and classification. American Mineralogist, 105, 109–122.

Biagioni, C., Ciriotti, M.E., Favreau, G., Mauro, D., and Zaccarini, F. (2022a) Graulichite-(La), $LaFe^{3+}_3(AsO_4)_2(OH)_6$, a new addition to the alunite supergroup from the Patte d'Oie mine, Bou Skour mining district, Morocco. European Journal of Mineralogy, 34(3), 365–374.

Biagioni, C., Sejkora, J., Moëlo, Y., Marcoux, E., Mauro, D., and Dolníček, Z. (2022b) Tennantite-(Cu), $Cu_{12}As_4S_{13}$, from Layo, Arequipa Department, Peru: a new addition to the tetrahedrite-group minerals. Mineralogical Magazine, 86(2), 331–339.

Biagioni, C., Sejkora, J., Musetti, S., Makovicky, E., Pagano, R., Pasero, M., and Dolníček, Z. (2022c) Stibiogoldfieldite, $Cu_{12}(Sb_2Te_2)S_{13}$, a new tetrahedrite-group mineral. Mineralogical Magazine, 86(1), 168–175.

Giester, G., Lengauer, C.L., N., C.C., Topa, D., Gutzmer, J., and von Bezing, K.-L. (2022) Saccoite, $Ca_2Mn^{3+}_2F(OH){\cdot}0.5(SO_4)$, a new, microporous mineral from the Kalahari Manganese Field, South Africa. Mineralogical Magazine, 1–7.

Hatert, F., Lefèvre, P., Pasero, M., and Fransolet, A.-M. (2003) Graulichite-(Ce) a new arsenate mineral from the Stavelot Massif, Belgium. European Journal of Mineralogy, 15(4), 733–739.

Kasatkin, A.V., Plášil, J., Chukanov, N.V., Škoda, R., Nestola, F., Agakhanov, A.A., and Belakovskiy, D.I. (2022) Gurzhiite, $Al(UO_2)(SO_4)_2F{\cdot}10H_2O$, a new uranyl sulfate mineral with a chain structure from the Bykogorskoe deposit, Northern Caucasus, Russia. Mineralogical Magazine, 86(3), 412–421.

Ma, C., Beckett, J.R., Tissot, F.L., and Rossman, G.R. (2022) New minerals in type A inclusions from Allende and clues to processes in the early solar system: Paqueite, $Ca_3TiSi_2(Al,Ti,Si)_3O_{14}$, and burnettite, $CaVAlSiO_6$. Meteoritics & Planetary Science, 57, 1300–1324.

Marcoux, E., Milési, J.P., and Moëlo, Y. (1994) Vinciennite and Cu-excess tennantite from the Layo (Cu Sn, As, Au) epithermal deposit (Southern Peru). Mineralogy and Petrology, 51(1), 21–36.

Missen, O.P., Mills, S.J., Kampf, A.R., Coolbaugh, M.F., Najorka, J., Rumsey, M.S., Marty, J., Spratt, J., Raudsepp, M., and McCormack, J.K. (2021) Wildcatite $CaFe^{3+}Te^{6+}O_5(OH)$, the second new tellurate mineral from the Detroit district, Juab County, Utah. Canadian Mineralogist, 59(4), 729–739.

Sharygin, V.V., Britvin, S.N., Kaminsky, F.V., Wirth, R., Nigmatulina, E.N., Yakovlev, G.A., Novoselov, K.A., and Murashko, M.N. (2021) Ellinaite, $CaCr_2O_4$, a new natural post-spinel oxide from Hatrurim Basin, Israel, and Juína kimberlite field, Brazil. European Journal of Mineralogy, 33(6), 727–742.

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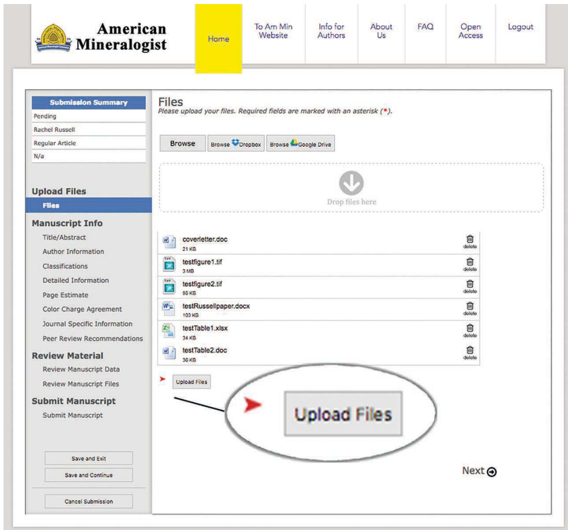

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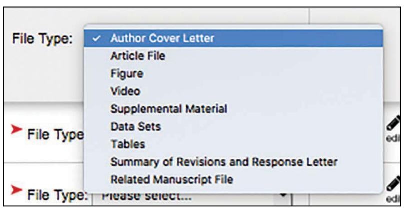

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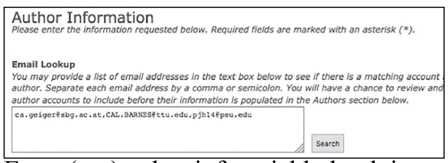

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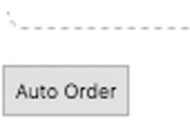

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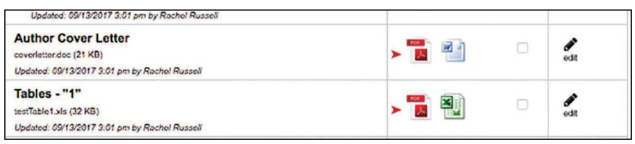

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