

New Mineral Names*

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IN THIS ISSUE

The following new minerals are discussed in this issue: ląngbanshyttanite, pseudolyonsite, and yangzhumingite. These new minerals have been described in the *European Journal of Mineralogy* and are reported here.

LĄNGBANSHYTTANITE*

N.V. Chukanov, I.V. Pekov, E. Jonsson, N.V. Zubkova, Y.E. Filinchuk, D.I. Belakovskiy, and D.Yu. Pushcharovsky (2011) Ląngbanshyttanite, a new low-temperature arsenate mineral with a novel structure from Ląngban, Sweden. *Eur. J. Mineral.* 23, 675–681.

The new mineral ląngbanshyttanite was discovered in a specimen from the Ląngban mine Filipstad district, Vąrmland County, Bergslagen ore province, Sweden. The carbonate-hosted Ląngban deposit (59.86°N, 14.27°E) is, together with related occurrences in the western part of the Palaeoproterozoic Bergslagen ore province in south central Sweden, characterized by anomalously Pb-As-Ba-Be-Sb-rich, metamorphosed stratabound Fe and Mn oxide ores with associated skarn units, sulfide assemblages, as well as abundant vein and fissure-hosted mineral assemblages. The name is for Ląngbanshyttan, which is the old name of both the mine, mining village, and smelter that in more recent times has been known plainly as “Ląngban” (Ląngbanshyttan actually means “Ląngban’s smelter” or “Ląngban’s furnace.”)

Ląngbanshyttanite occurs as a very late, low-temperature species in the deposit. It crystallized during the last stage of hydrothermal activity involving metal remobilization in the Ląngban system, post-dating regional metamorphism of the volcanic-hydrothermal ores and their host rocks. Based on existing evidence, these minerals formed at very low temperature and pressure, in this case most likely below 70 °C. The mineral formed in fractures and corrosion-veinlets, post-dating calcite, in a Mn-oxide-bearing, Mn-silicate-rich rock. Associated late-stage minerals are calcite, antigorite, sparse euhedral trigonite, and a few microscopic aggregates of a so far unidentified As-bearing mineral. Typically, both calcite and antigorite exhibit evidence of being partly corroded away prior to ląngbanshyttanite formation. Trigonite, coeval with ląngbanshyttanite, occurs as sparse, euhedral crystals. The groundmass to the veinlets or fractures mainly consists of reddish brown, fine- to medium-grained Mn-bearing phlogopite with disseminated subhedral grains of jacobsonite–magnetite series spinel. No minerals or synthetic compounds chemically and structurally closely related to ląngbanshyttanite have been found in the literature and databases.

X-ray powder-diffraction data for ląngbanshyttanite were ob-

tained using a Stoe IPDS II image plate diffractometer (Gandolfi geometry) with a detector-to-sample distance of 200 mm. The strongest lines of the powder diffraction pattern [d_{obs} in Å (I_{obs} %, hkl)] are: 14.48 (100, 001), 7.21 (43, 002), 4.969 (34, 100 101), 4.798 (28, 003), 3.571 (54, 112 $\bar{1}\bar{1}$ 013 11 $\bar{1}$), 2.857 (45, 020 021 114), 2.800 (34, 113). A single crystal was studied using synchrotron radiation at the Swiss-Norwegian Beam Lines (SNBL) at the European Synchrotron Radiation Facility (ESRF), Grenoble, France. Diffraction data were collected at room temperature using the MAR345 image plate detector, at a wavelength 0.83212 Å. The following results were obtained: ląngbanshyttanite is triclinic, space group: $P\bar{1}$, $a = 5.0528(10)$, $b = 5.7671(6)$, $c = 14.617(3)$ Å, $\alpha = 85.656(14)$, $\beta = 82.029(17)$, $\gamma = 88.728(13)^\circ$, $V = 420.6(2)$ Å³, $Z = 1$.

The electron-microprobe analyses were performed using a fully computer-controlled scanning electron microscope VEGA TS 5130MM equipped with energy-dispersive X-ray (EDX) microanalyzer with an INCA Energy semiconductor Si(Li) detector, at an operating voltage of 15.7 kV and a beam current of 0.5 nA. The electron beam was rastered over an area 2×2 mm². The correctness of Mg and As determination was proved using talmessite as a test sample. Na, K, Ca, Sr, Ba, Zn, Ni, V, Sb, Al, Ti, Si, S, Cl, and F were below detection limits. H₂O was determined by gas chromatography of the products of ignition at 1200 °C. CO₂ was not analyzed because of absence of bands corresponding to C–O vibrations in the IR spectrum (see below).

The editors of *American Mineralogist* are pleased to announce the new team handling the New Mineral Name section of the journal. Headed by Kimberly T. Tait (Royal Ontario Museum, Toronto, Canada), they are Dmitry Belakovskiy (Fersman Mineralogical Museum, Moscow, Russia), Fernando Cámara (Università di degli Studi di Torino, Torino, Italy), G. Diego Gatta (Università degli Studi di Milano, Milano, Italy), John Rakovan (Miami University, Oxford, Ohio, U.S.A.), and Mark D. Welch (The Natural History Museum, London, U.K.).

The New Minerals Name section appears periodically in the journal and highlights new mineral descriptions in journals worldwide, for the interest of our readers. We welcome this new group of contributors to the journal and look forward to their exciting summaries of the new contributions to mineralogy.

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

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The empirical formula of ląngbanshyttanite based on 18 O atoms is $\text{Pb}_{1.97}\text{Mn}_{1.85}\text{Mg}_{0.93}\text{Fe}_{0.26}(\text{AsO}_4)_{1.96}(\text{PO}_4)_{0.09}(\text{OH})_{3.87} \cdot 5.93\text{H}_2\text{O}$. The simplified formula is $\text{Pb}_2\text{Mn}_2\text{Mg}(\text{AsO}_4)_2(\text{OH})_4 \cdot 6\text{H}_2\text{O}$, which requires PbO 44.53, MgO 4.02, MnO 14.15, As_2O_5 22.93, H_2O 14.38, total 100.00 wt%. The Gladstone-Dale compatibility index calculated from the empirical formula is $1 - (K_p/K_c) = -0.040$ (good).

Ląngbanshyttanite forms unoriented, felty to distinctly radial, hemispherical white aggregates up to 1 mm in size composed of acicular, lath-like crystals, mostly occurring on a groundmass of partly corroded, pinkish to pale beige antigorite, often in direct association with corroded remnants of calcite. The exceedingly soft and brittle nature of the mineral prevented isolation and study of crystals or single-crystal fragments larger than $5 \times 10 \times 120$ mm. Ląngbanshyttanite is transparent, colorless, with vitreous luster. The streak is white. It shows perfect cleavage on (001). Hardness could not be measured because the crystals are very thin, brittle, and loosely aggregated. Calculated density is 3.951 g/cm^3 . Minute crystal fragments immersed in dilute hydrochloric acid rapidly decompose to a white mass, with generation of a few small gas bubbles. Optically, the new mineral is biaxial (+), $\alpha = 1.700(5)$, $\beta = 1.741(5)$, $\gamma = 1.792(5)$, $2V$ (meas) $\approx 90^\circ$, $2V$ (calc) $= 86^\circ$. Dispersion is strong, $r < v$. Orientation: $X \approx c$, the angle between Z and elongation direction is 16° . Under the microscope, ląngbanshyttanite is colorless, nonpleochroic. No response could be observed in short- and long-wave ultraviolet light.

In the structure of ląngbanshyttanite, isolated zigzag columns running along the *b* axis are built up by edge-sharing $\text{MnO}_2(\text{OH})_4$ octahedra with the average Mn–O distance of 2.22 Å. These columns are linked by isolated AsO_4 tetrahedra to form heteropolyhedral block coplanar to (001).

Topologically, heteropolyhedral blocks in ląngbanshyttanite are close to that found in the structures of the copper arsenates geminite, $\text{Cu}(\text{AsO}_3\text{OH}) \cdot \text{H}_2\text{O}$, yvonite, $\text{Cu}(\text{AsO}_3\text{OH}) \cdot 2\text{H}_2\text{O}$, and lindackerite, $(\text{Cu}, \text{Co}, \text{Ni})\text{Cu}_4(\text{AsO}_4)_2(\text{AsO}_3\text{OH})_2 \cdot 9\text{H}_2\text{O}$. The blocks $[\text{Mn}_2(\text{OH})_2(\text{AsO}_4)_2]_{\text{cor}}$ found in ląngbanshyttanite can be compared with heteropolyhedral layers of tsumcorite and tsumcorite-type minerals and compounds, as well as natrochalcite, $\text{NaCu}_2(\text{SO}_4)_2(\text{OH}) \cdot \text{H}_2\text{O}$, and natrochalcite-type compounds including sulfates, selenates, chromates and molybdates with general formula $A\text{Me}_2(\text{XO}_4)_2[(\text{H}_2\text{O})(\text{OH})]$ where $A = \text{Na}, \text{K}, \text{Rb}, \text{Ag}, \text{TI}, \text{NH}_4$; $\text{Me} = \text{Cu}, \text{Co}, \text{Ni}, \text{Zn}$; $X = \text{S}, \text{Se}, \text{Mo}, \text{Cr}$.

The mineral and its name have been approved by the IMA Commission on New Minerals, Nomenclature and Classification (IMA no. 2010-071). Parts of the holotype specimen of ląngbanshyttanite are deposited in the collections of the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow, Russia, registration number 4032/1, and in the collections of the Swedish Museum of Natural History, Stockholm, Sweden, catalog number NRM 20100076. **K.T.T.**

PSEUDOLYONSITE*

M.E. Zelenski, N.V. Zubkova, I.V. Pekov, M. M. Boldyreva, D.Yu. Pushcharovsky, and A.N. Nekrasov (2011) Pseudolyonsite, $\text{Cu}_3(\text{VO}_4)_2$, a new mineral species from the Tolbachik volcano, Kamchatka Peninsula, Russia. *Eur. J. Mineral.*, 23, 475–481.

Pseudolyonsite, ideally $\text{Cu}_3(\text{VO}_4)_2$, is a new mineral from the medium-temperature fumaroles of the New Tolbachik scoria

cones, Tolbachik volcano, Kamchatka Peninsula, Russia. Pseudolyonsite was found among other fumarolic minerals in the Yadovitaya (“Poisonous”) fumarole, Second cone, New Tolbachik scoria cones, Kamchatka Peninsula, Far East Asia, Russia. The cones ($55^\circ 41' \text{N}$, $160^\circ 14' \text{E}$, 1200 masl) are monogenetic volcanoes that formed during the Tolbachik Fissure eruption in 1975. The volatile transport of metals together with gas-rock interaction, abruptly changing temperature and f_{O_2} near the fumarole orifice provide a diversity of mineral species in the sublimates. Since 1982, 32 new mineral species have been described from the New Tolbachik scoria cones; as of 2010, only seven have been found elsewhere. Pseudolyonsite, as most other minerals discovered on Tolbachik, occurs in cavities from several centimeters to 1.5 m in size under the surface crust.

Pseudolyonsite is one of the rarest minerals of Tolbachik. It is commonly present as an overgrowth on acicular piypite. Crystals occur as needles that are up to 0.5 mm long and $5\text{--}20 \mu\text{m}$ across. The crystals are separate, or they form parallel intergrowths sprays or openwork clusters up to 1 mm. Pseudolyonsite was most likely deposited at a temperature ranging from 200 to 300°C . Closely associated minerals are piypite, palmierite, lyonsite, and hematite. Other spatially related minerals are magnetite, aphtitalite, langbeinite, filatovite, lammerite, vergasovaite, rutile, and native gold.

A $0.05 \times 0.06 \times 0.35$ mm pseudolyonsite crystal was used for structure determination at room temperature with an Xcalibur S diffractometer equipped with a CCD detector. A total of 7679 reflections were obtained within a θ range of 3.50 to 32.58° . Pseudolyonsite is monoclinic: $P2_1/c$, $a = 6.2695(4)$, $b = 8.0195(3)$, $c = 6.3620(3)$ Å, $\beta = 111.96(1)^\circ$, $V = 296.66(3)$ Å³, $Z = 2$. The crystal structure of the pseudolyonsite was solved through direct methods and was refined anisotropically to $R = 0.0444$ for 707 unique reflections with $I > 2\sigma(I)$. The X-ray powder diffraction pattern of pseudolyonsite was determined using a 57.3-mm Debye-Scherrer camera (Ni-filtered $\text{CuK}\alpha$ radiation). The strongest powder X-ray diffraction lines [d_{obs} in Å (I_{obs} %, hkl)] are: 4.70 (60, 110), 3.30 (79, 021 120), 3.22 (87, 111), 3.18 (34, $\bar{1}21$ $\bar{1}02$), 2.894 (74, 200 $\bar{2}11$), 2.761 (100, 012), 2.479 (59, $\bar{2}12$ $\bar{1}22$), 2.419 (67, 031 130).

Crystals of pseudolyonsite were studied with a Tescan Vega II XMU scanning electron microscope equipped with Inca Energy and Inca Wave microanalysis systems (IEM RAS, Chernogolovka, Russia) at 20 kV and 0.5 nA. The diameter of the beam was 0.26 mm, and the counting time was 180 s. Four electron probe (EDS) analyses produced the following mean values: V_2O_5 40.37, CuO 48.83, ZnO 7.60, MoO_3 1.89, and SiO_2 0.14, total 98.83 wt%, which corresponds, on the basis of 8 O atoms, to $(\text{Cu}_{2.58}\text{Zn}_{0.44})_{\Sigma 3.02}(\text{V}_{1.88}\text{Mo}_{0.06}\text{Si}_{0.02})_{\Sigma 1.96}\text{O}_8$. The idealized formula is $\text{Cu}_3(\text{VO}_4)_2$.

Pseudolyonsite is dark red with a brownish tint. Thick needles or parallel intergrowths may be black. The mineral is translucent to opaque, has a reddish-brown streak, and has an adamantine to semi-metallic luster. Pseudolyonsite is brittle, but thin long needles are flexible and elastic. The fracture is conchoidal, and no cleavage has been observed. The density has not been measured because of the small size of the crystals. The calculated density (from the empirical formula and single-crystal X-ray data) is 4.749 g/cm^3 . The Mohs hardness is 2–3. Under the microscope in reflected light, pseudolyonsite is gray with a weak bluish tint. Pleochroism is not observed, and the birefractance is weak. The mineral has strong red internal reflections. The anisotropy is

distinct, however, in case of thin needles, it is barely observable because of strong internal reflections. The reflectance values (R_1 and R_2 , %) in air for the four COM wavelengths are, respectively, 17.05, 19.6 (470 nm); 16.1, 18.15 (546 nm); 15.85, 17.7 (589 nm); and 15.55, 17.4 (650 nm).

Pseudolyonsite is isostructural with a synthetic monoclinic $\text{Cu}_3(\text{VO}_4)_2$. Its crystal structure is formed by chains of edge-sharing distorted octahedra involving Cu2 running along the c axis and connected to each other by distorted octahedral involving Cu1. The octahedra of both types contain Cu and subordinate Zn. The corrugated octahedral layers are connected to each other by VO_4 tetrahedra. Both types of Cu octahedra are typically Jahn-Teller-distorted with four shorter and two longer Cu–O bonds. This distortion leads to a reduction of the symmetry to monoclinic in comparison with other closely related synthetic vanadates with the general formula $M_3(\text{VO}_4)_2$ ($M = \text{Mg}, \text{Ni}, \text{Co}, \text{Zn}$). In these compounds, the M octahedra are relatively undistorted and, as a result, the symmetry is orthorhombic, with the space group $Cmca$.

The type specimen is deposited in the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow (registration no. 3879/1). **K.T.T.**

YANGZHUMINGITE*

R. Miyawaki, H. Shimazaki, M. Shigeoka, K. Yokoyama, S. Matsubara, and H. Yurimoto (2011) Yangzhumingite, $\text{KMg}_{2.5}\text{Si}_4\text{O}_{10}\text{F}_2$, a new mineral in the mica group from Bayan Obo, Inner Mongolia, China. *Eur. J. Mineral.*, 23, 467–473.

Yangzhumingite, ideally $\text{KMg}_{2.5}\text{Si}_4\text{O}_{10}\text{F}_2$, is a new mineral species from Bayan Obo, a world-class Nb–REE–Fe deposit, located in Inner Mongolia, China (109°57'E, 41°46'N). Yangzhumingite occurs in one of the band textures of metamorphosed carbonate rock found in the transition zone between the dolomite and slate at the southern part of East orebody, Bayan Obo. Associated minerals in the Al- and Fe-deficient part are: dolomite, calcite, tremolite, norbergite, and huanghoite-(Ce) with minor phlogopite, barite, bastnäsite-(Ce), parisite-(Ce), and fluorite. Micaceous grains were recognized in a thin section of a specimen of metamorphosed carbonate rock. The metamorphosed carbonate rock was collected from the outcrop same to that of the deep purple fluorite rock including the type specimen of zhangpeishanite, BaFCl . To date, nearly 200 mineral species have been so far identified from the Bayan Obo deposit. Yangzhumingite is a member of the mica group (Strunz and Nickel class 9.EC.10: Strunz and Nickel 2001) and, through its tetrasilicic, fluorine-dominant, and interlayer K-dominant character, it represents the Mg-analog of montdorite. The synthetic equivalent of yangzhumingite is a white powder and is used in paint compounding agents and lubricants. Single-crystal X-ray studies could not be carried out. The fragments picked out from the thin section used for the chemical analysis were curved and cleaved too finely for single-crystal XRD measurement. X-ray powder-diffraction data were collected using a 114.6 mm diameter Gandolfi camera (Ni-filtered $\text{CuK}\alpha$ radiation). Yangzhumingite is monoclinic, space group $C2/m$, with unit-cell parameters $a = 5.249(4)$, $b = 9.095(5)$, $c = 10.142(5)$ Å, $\beta = 99.96(6)^\circ$, $V = 476.9(5)$ Å³, $Z = 2$. The $a:b:c$

ratio calculated from the unit-cell parameters is 0.577:1:1.115. The five strongest lines in the powder XRD pattern are [d_{obs} in Å (I_{obs} %, hkl): 10.03 (95, 001); 3.37, (48, 022), 2.90 (49, 113), 2.59 (67, 13 $\bar{1}$ 200), 2.41 (100, 132 201).

Chemical analyses of yangzhumingite (15 spots) were carried out by means of an electron microprobe JEOL JXA-8800M, operating at 15 kV and 20 nA, with 2 mm beam diameter. The Li content was determined by means of a Cameca IMS-3f secondary ion mass spectrometer (SIMS) at Hokkaido University. The primary ion beam was mass filtered 16O-accelerated to 14.5 keV and adjusted for a beam current of about 7 nA with a spot size of about 10 μm. The mean of 15 electron microprobe analyses and SIMS analysis for Li lead to the empirical formula $(\text{K}_{0.70}\text{Li}_{0.30}\text{Na}_{0.01})(\text{Mg}_{2.48}\text{Fe}_{0.06})(\text{Si}_{3.96}\text{Al}_{0.03})\text{O}_{10}[\text{F}_{1.92}(\text{OH})_{0.08}]$ or $(\text{K}_{0.70}\text{Na}_{0.01})(\text{Mg}_{2.48}\text{Li}_{0.30}\text{Fe}_{0.06})(\text{Si}_{3.96}\text{Al}_{0.03})\text{O}_{10}[\text{F}_{1.92}(\text{OH})_{0.08}]$ on the basis of 12 anions with $(\text{F} + \text{OH}) = 2$. Regardless of the structural position of Li, as shown below, the ideal formula is $\text{KMg}_{2.5}\text{Si}_4\text{O}_{10}\text{F}_2$, which requires K_2O 11.48, MgO 24.56, SiO_2 58.59, F 9.26, $\text{F}=\text{O}$ –3.90, total 100 wt%.

Yangzhumingite occurs as subhedral to euhedral platy crystals ranging in size from several tens to several hundreds of micrometers across. It is transparent and colorless with white streak and pearly luster. No fluorescence was observed under short- or long-wave UV light. Hardness could not be measured because of small grain size. The synthetic of yangzhumingite showed 3 on the Mohs hardness scale. Yangzhumingite is flexible and elastic. It shows a perfect cleavage on {001}. Density of yangzhumingite could not be measured because of small grain size, whereas the calculated density is 2.807 g/cm³ on the basis of the empirical formula and unit-cell values. The optical data of yangzhumingite are: biaxial (–), $n(\text{minimum}) = 1.532$, $n(\text{maximum}) = 1.537$ (589 nm), and $2V(\text{meas}) = 5\text{--}10^\circ$. No pleochroism was observed.

The length of the b -axis in yangzhumingite is closely related to the size of the octahedral sites in micas. The structural position of Li, the minor constituent, in yangzhumingite is an interesting subject from viewpoint of crystal chemistry. The univalent Li^+ usually occupies the octahedral sites in mica-group minerals. With the length of the b -parameter, it is speculated that, in yangzhumingite, Li^+ ions do not occupy the octahedral site, but rather replace the interlayer K^+ . The structure model with Li^+ in interlayer suggests a solid solution between the ideal formula of yangzhumingite [$\text{KMg}_{2.5}\text{Si}_4\text{O}_{10}\text{F}_2$] and a hypothetical $\text{LiMg}_{2.5}\text{Si}_4\text{O}_{10}\text{F}_2$. A smaller Li^+ can substitute a part of larger K^+ in a cavity of tight framework, whereas the larger cation cannot replace the smaller cation without effect on the framework. The minor (0.3 apfu) Li^+ seems to stay in a large interlayer space, which is borne by the major (0.7 apfu) K^+ at the neighboring interlayer cation sites in the crystal structure of yangzhumingite.

The mineral and name were approved by the IMA Commission on New Minerals, Nomenclature and Classification (IMA2009-017). The name is for Zhuming Yang, (born 1951), mineralogist and crystallographer, in recognition of his contributions to the mineralogy of Bayan Obo. The type material is housed in the National Museum of Nature and Science, Tokyo, Japan, and the Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China, under the registered number NSM-MF15361 and KDX015, respectively. **K.T.T.**