New Mineral Names*

PAULA C. PIILONEN,†‡ ANDREW J. LOCOCO,2 RALPH ROWE,1 AND T. SCOTT ERCIT†‡

1 Research Division, Canadian Museum of Nature, P.O. Box 3443, Stn. D, Ottawa, Ontario K1P 6P4, Canada
2 Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton T6G 2E3 Canada

The unnamed mineral that was investigated is found at the Byrud emerald mine, in Eidsvoll, Akershus, southern Norway. The mineralization is associated with syenitic pegmatites and Permian trachytic dikes. The mineral occurs as inclusions in feldspar and quartz with Ta- and Nb-rich rutile, as well as V-rich rutile. The crystals are prismatic, needle- or lath-shaped, up to 1 mm in length and are commonly striated as a result of polysynthetic twinning. The presence of substantial Be and minor Li was verified but not quantified by analysis with an ion microprobe (SIMS). If the content of Be is reduced to 0.84 pfu, in accord with the results of the structure refinement, then the content of Be is 0.84 and the sum is 97.15 wt%, with the empirical formula (Be0.84V1.21Ti1.25Cr0.30Fe0.09Al0.07)Σ3.03O6, ideally Be(V2Ti)O6.

(P·V(1), Ti)O6

The unnamed mineral that was investigated is found at the Byrud emerald mine, in Eidsvoll, Akershus, southern Norway. The mineralization is associated with syenitic pegmatites that transect Cambrian black shales and Permian trachytic dikes. The mineral occurs as inclusions in feldspar and quartz with Ta- and Nb-rich rutile, as well as V-rich rutile. The crystals are prismatic, needle- or lath-shaped, up to 1 mm in length and are commonly striated as a result of polysynthetic twinning. The mean of six electron microprobe analyses gave BeO (calc for 1 Be pfu) 9.92, Al2O3 1.44, V2O3 37.86, Cr2O3 8.79, Fe2O3 2.66, TiO2 38.36, sum 99.03 wt%, corresponding (on the basis of 6 O) to: Be(V1.27Ti1.21Cr0.29Fe0.08Al0.07)Σ3.03O6. The presence of substantial Be and minor Li was verified but not quantified by analysis with an ion microprobe (SIMS). If the content of Be is reduced to 0.84 pfu, in accord with the results of the structure refinement, then the content of Be is 0.84 and the sum is 97.15 wt%, with the empirical formula (Be0.47V1.27Ti1.21Cr0.29Fe0.08Al0.07)Σ3.03O6, ideally Be(V2Ti)O6.

Single-crystal X-ray study (R1 = 0.045) of a twinned crystal, twin plane [210], revealed the mineral to be orthorhombic, space group Pnma, a = 9.982(1), b = 8.502(1), c = 4.5480(6) Å, V = 385.97(9) Å3, Z = 4, Dcalc = 3.77 g/cm3, is eight times larger than that of the mineral investigated, and is suspected to be a supercell result from twinning. Despite several requests, the authors have been unable to obtain holotype samples of kyzylkumite from the appropriate institutions in St. Petersburg, Russia. Material alleged to be kyzylkumite was obtained from individual and commercial sources; the results of electron- and ion-microprobe analysis yielded the empirical formula (Be0.47V1.27Ti1.21Cr0.29Fe0.08Al0.07)Σ3.03O6, ideally Be(V2Ti)O6.

The authors state that the measured and calculated diffraction patterns are very similar to that of kyzylkumite, nominally V2Ti3O9. The unit cell originally reported for kyzylkumite, a = 33.80(5), b = 4.578(5), c = 19.993(3) Å, β = 93.40(5)°, V = 3087.7 Å3, Z = 18, Dcalc = 3.77 g/cm3, is eight times larger than that of the mineral investigated, and is suspected to be a supercell result from twinning. Despite several requests, the authors have been unable to obtain holotype samples of kyzylkumite from the appropriate institutions in St. Petersburg, Russia. Material alleged to be kyzylkumite was obtained from individual and commercial sources; the results of electron- and ion-microprobe analysis yielded the empirical formula (Be0.47V1.27Ti1.21Cr0.29Fe0.08Al0.07)Σ3.03O6, ideally Be(V2Ti)O6.

New Mineral Names*

PAULA C. PIILONEN,‡ ANDREW J. LOCOCO, RALPH ROWE,1 AND T. SCOTT ERCIT†‡

1 Research Division, Canadian Museum of Nature, P.O. Box 3443, Stn. D, Ottawa, Ontario K1P 6P4, Canada
2 Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton T6G 2E3 Canada

(0003-004X/07/0004–703$05.00/DOI: 10.2138/am.2007.488      703

American Mineralogist, Volume 92, pages 703–707, 2007

The crystal structure of (P·V(1), Ti)O6, a mineral related to kyzylkumite. Can. Mineral., 44, 1147–1158.

The unnamed mineral that was investigated is found at the Byrud emerald mine, in Eidsvoll, Akershus, southern Norway. The mineralization is associated with syenitic pegmatites that transect Cambrian black shales and Permian trachytic dikes. The mineral occurs as inclusions in feldspar and quartz with Ta- and Nb-rich rutile, as well as V-rich rutile. The crystals are prismatic, needle- or lath-shaped, up to 1 mm in length and are commonly striated as a result of polysynthetic twinning. The mean of six electron microprobe analyses gave BeO (calc for 1 Be pfu) 9.92, Al2O3 1.44, V2O3 37.86, Cr2O3 8.79, Fe2O3 2.66, TiO2 38.36, sum 99.03 wt%, corresponding (on the basis of 6 O) to: Be(V1.27Ti1.21Cr0.29Fe0.08Al0.07)Σ3.03O6. The presence of substantial Be and minor Li was verified but not quantified by analysis with an ion microprobe (SIMS). If the content of Be is reduced to 0.84 pfu, in accord with the results of the structure refinement, then the content of Be is 0.84 and the sum is 97.15 wt%, with the empirical formula (Be0.47V1.27Ti1.21Cr0.29Fe0.08Al0.07)Σ3.03O6, ideally Be(V2Ti)O6.

Single-crystal X-ray study (R1 = 0.045) of a twinned crystal, twin plane [210], revealed the mineral to be orthorhombic, space group Pnma, a = 9.982(1), b = 8.502(1), c = 4.5480(6) Å, V = 385.97(9) Å3, Z = 4, Dcalc = 3.77 g/cm3, is eight times larger than that of the mineral investigated, and is suspected to be a supercell result from twinning. Despite several requests, the authors have been unable to obtain holotype samples of kyzylkumite from the appropriate institutions in St. Petersburg, Russia. Material alleged to be kyzylkumite was obtained from individual and commercial sources; the results of electron- and ion-microprobe analysis yielded the empirical formula (Be0.47V1.27Ti1.21Cr0.29Fe0.08Al0.07)Σ3.03O6, ideally Be(V2Ti)O6.

The authors state that the measured and calculated diffraction patterns are very similar to that of kyzylkumite, nominally V2Ti3O9. The unit cell originally reported for kyzylkumite, a = 33.80(5), b = 4.578(5), c = 19.993(3) Å, β = 93.40(5)°, V = 3087.7 Å3, Z = 18, Dcalc = 3.77 g/cm3, is eight times larger than that of the mineral investigated, and is suspected to be a supercell result from twinning. Despite several requests, the authors have been unable to obtain holotype samples of kyzylkumite from the appropriate institutions in St. Petersburg, Russia. Material alleged to be kyzylkumite was obtained from individual and commercial sources; the results of electron- and ion-microprobe analysis yielded the empirical formula (Be0.47V1.27Ti1.21Cr0.29Fe0.08Al0.07)Σ3.03O6, ideally Be(V2Ti)O6.

The authors state that the measured and calculated diffraction patterns are very similar to that of kyzylkumite, nominally V2Ti3O9. The unit cell originally reported for kyzylkumite, a = 33.80(5), b = 4.578(5), c = 19.993(3) Å, β = 93.40(5)°, V = 3087.7 Å3, Z = 18, Dcalc = 3.77 g/cm3, is eight times larger than that of the mineral investigated, and is suspected to be a supercell result from twinning. Despite several requests, the authors have been unable to obtain holotype samples of kyzylkumite from the appropriate institutions in St. Petersburg, Russia. Material alleged to be kyzylkumite was obtained from individual and commercial sources; the results of electron- and ion-microprobe analysis yielded the empirical formula (Be0.47V1.27Ti1.21Cr0.29Fe0.08Al0.07)Σ3.03O6, ideally Be(V2Ti)O6.
\( \gamma = 1.662, 2 \gamma_{\text{obs}} = 61^\circ \), no dispersion observed. It is pleochroic yellow-brown (\( \alpha \)) to light brown (\( \beta \) and \( \gamma \)).

According to the work done with a Bruker Apex CCD diffractometer on a single crystal (0.31 \( \times \) 0.05 \( \times \) 0.05 mm) fluoro-magnesiohastingsite is monoclinic, \( \text{C}2 \text{/m} \) with unit-cell parameters refined from powder X-ray diffraction data: \( a = 9.871(1), b = 8.006(2), c = 5.314(1) \text{ Å}, \beta = 105.37(1)^\circ, V = 910.7(2) \text{ Å}^3, Z = 2, D_{\text{calc}} = 3.13 \text{ g/cm}^3 \). The crystal structure was refined to \( R_1 = 0.054 \) for 903 reflections with \( F_2 > 4 \sigma (F_2) \).

The strongest lines on the X-ray powder diffraction pattern (D5000 diffractometer, burker AXS, twin-Goebel mirrors, Cu Kα radiation, 34 lines) include 9.008(27,020), 8.421(100,205), 7.995(15,040), 7.334(23,421), 7.296(18,321), 7.156(25,261), 7.040(10,202), 3.377(44,131), 3.271(61,240), 3.124(100,310), 2.932(15,221), 2.805(28,330), 2.746(31,331), 2.700(54,151), 2.658(25,061), 2.590(54,039), 2.557(31,331), 2.500(12,400), 2.330(23,721), 2.2969(18,321), 2.1565(25,261), 2.0649(10,202), 1.9661(11,402), 1.9114(11,351), 1.8933(15,510), 1.6458(26,461), 1.6130(22,111.0), 1.5864(10,600), 1.4413(23,661).

The mineral was found in small cavities in an altered hematite-rich xenolith in an abandoned trachyandesite quarry at Dealul Uroi, 10 km east of Deva, Hunedoara County, Romania. Dealul Uroi was an active volcano in the Apuseni Mountains 1.6 Ma ago. It is associated with titaniferous hematite, augite, phlogopite, enstatite, feldspar, tridymite, titanite, fluorapatite, ilmenite, and pseudobrookite. The mineral is named in honor of the amphibole nomenclature scheme of the subcommittee on amphiboles in the Department of Mineralogy of the Landesmuseum Joanneum Graz (catalog no. 83854-83855).

**GEORGBARSANOVITE**


Georgbarsanovite (collected prior to 1963) came from boulders of nepheline-feldspar pegmatite in the upper reaches of the Petrelisua River valley, Khibiny alkaline massif, Kola Peninsula, Russia. It and niobian eudialyte replace earlier eudialyte associated with cancrinite, albite, aegirine-augite, alkali amphibole, and biotite. Georgbarsanovite and eudialyte form irregular, multicolored aggregates to 8–10 cm, ranging from pink (earlier eudialyte) to light brown (georgbarsanovite). It is pleochroic with unit-cell parameters refined from powder X-ray diffraction data (D5000 diffractometer, burker AXS, twin-Goebel mirrors, Cu Kα radiation, 34 lines) include 9.008(27,020), 8.421(100,205), 7.995(15,040), 7.334(23,421), 7.296(18,321), 7.156(25,261), 7.040(10,202), 3.377(44,131), 3.271(61,240), 3.124(100,310), 2.932(15,221), 2.805(28,330), 2.746(31,331), 2.700(54,151), 2.658(25,061), 2.590(54,039), 2.557(31,331), 2.500(12,400), 2.330(23,721), 2.2969(18,321), 2.1565(25,261), 2.0649(10,202), 1.9661(11,402), 1.9114(11,351), 1.8933(15,510), 1.6458(26,461), 1.6130(22,111.0), 1.5864(10,600), 1.4413(23,661).

The mineral was found in small cavities in an altered hematite-rich xenolith in an abandoned trachyandesite quarry at Dealul Uroi, 10 km east of Deva, Hunedoara County, Romania. Dealul Uroi was an active volcano in the Apuseni Mountains 1.6 Ma ago. It is associated with titaniferous hematite, augite, phlogopite, enstatite, feldspar, tridymite, titanite, fluorapatite, ilmenite, and pseudobrookite. The mineral is named in honor of the amphibole nomenclature scheme of the subcommittee on amphiboles in the Department of Mineralogy of the Landesmuseum Joanneum Graz (catalog no. 83854-83855).

**MANGANIANDROSITE-(Ce)**


Two new species of epidote-group minerals have been described from carbonate pods in Mn-rich metacherts. Manganiandrosite-(Ce) was discovered in the Praborna Mn deposit, Saint-Marcel, Val d’Aosta, Italy, which belongs to the eclogitic facies ophiolitic Zermatt-Sasas Unit within the Western Alps. The deposits occur as quartz-rich lenses intercalated with eclogitic facies ophiolitic Zermatt-Sasas Unit within the Western Alps. The deposits occur as quartz-rich lenses intercalated with eclogitic facies ophiolitic Zermatt-Sasas Unit within the Western Alps. The deposits occur as quartz-rich lenses intercalated with eclogitic facies ophiolitic Zermatt-Sasas Unit within the Western Alps. The deposits occur as quartz-rich lenses intercalated with eclogitic facies ophiolitic Zermatt-Sasas Unit within the Western Alps.
dark brown, has a reddish brown streak, is vitreous to adamantine, brittle, and has no discernable cleavage. It is transparent under the electron beam, biaxial positive, $\alpha > 1.74$, $n_{\text{calc}} = 1.80$, strongly pleochroic with $\alpha$ light yellow, $\beta$ orange-brown, $\gamma$ red-brown, $2V_{\text{max}} = 80.6^\circ(1.5)^\circ$. A full optical characterization was not possible due to the strong absorption and high refractive index. Chemical analyses of manganandrosite-(Ce) [WDS, 4 analyses, average (range)] gave SiO$_2$ 28.81 (28.8–29.5), Al$_2$O$_3$ 9.65 (9.1–10.6), Mn$_2$O$_3$ 17.78 (17.3–23.2), MnO 1.75, MgO 1.22 (1.2–2.9), SrO 0 (0–0.07), CaO 2.57 (2.4–4.6), CeO$_3$ 16.14 (14.0–16.1), SrO 0 (0–0.07), F 0.57 (0.6–1.5), H$_2$O$_{\text{calc}}$ 1.44, sum 96.36 wt%. The structural characterization was not possible due to the strong absorption and high refractive index. Chemical analyses of manganiandrosite-(Ce) [WDS, average of 8 analyses (range)] gave SiO$_2$ 29.04 (28.7–29.3), Al$_2$O$_3$ 8.20 (7.6–8.5), TiO$_2$ 1.26 (0.8–1.5), Fe$_2$O$_3$ 2.98 (1.9–3.4), MnO 15.01 (14.0–15.8), Mn$_2$O$_3$ 11.24 (11.4–12.9), MgO 0.28 (0.2–0.4), SrO 1.17 (0.4–1.7), CaO 3.82 (3.6–4.2), CeO$_3$ 12.22 (11.8–13.0), LaO$_2$ 6.08 (5.6–6.4), Nd$_2$O$_3$ 3.24 (3.0–3.7), Sm$_2$O$_3$ 0.18 (0–0.4), F 0.07 (0–0.14), H$_2$O$_{\text{calc}}$ 1.45, sum 96.59 wt%. This corresponds to a structural formula, based on Si$_{10}$O$_{30}$(F,OH), of [Mn$_{10.4}$Si$_{20}$]$_{2}$[Ce$_{0.6}$La$_{0.2}$Nd$_{0.2}$Sm$_{0.0}$]

### SR-Na-REE Titанаты


Potentially new Sr-Na-REE enriched members of the crichtonite group from a fennitized megakamelon in the Khibina alkaline complex, Kola Peninsula, Russia, have been studied by WDS electron-microprobe methods. Chemical analyses (WDS, N = 1408, n.d. = not detected) gave averages (ranges) of TiO$_2$ 68.39 (64.66–73.28), ZrO$_2$ 2.55 (0.74–4.71), FeO 17.53 (15.49–19.15), MnO 1.43 (0.28–2.23), MgO 0.47 (n.d.–0.78), ZnO 0.12 (n.d.–0.36), Cr$_2$O$_3$ 0.52 (0.25–1.87), SrO 1.0 (n.d.–0.42), CaO 1.58 (0.90–2.53), BaO n.d. (n.d.–0.28), NiO n.d. (n.d.–1.56), V$_2$O$_5$ 0.46 (0.32–0.60), CeO$_2$ 0.98 (n.d.–3.99), La$_2$O$_3$ 0.10 (n.d.–0.35), Pr$_2$O$_3$ n.d. (n.d.–0.40), Y$_2$O$_3$ n.d. (Nb$_2$O$_5$ 0.42 (0.12–0.16), ThO$_2$ 0.13 (n.d.–0.99), total 98.89 wt%. These ranges correspond to atoms per formula unit (based on 38 oxygen) of Ti 14.81–15.65, Zr 0.11–0.66, Fe 3.86–4.76, Mn 0.07–0.56, Mg 0–0.34, Zn 0–0.08, Cr 0.06–0.45, Sr 0–0.75, Ca 0.29–0.80, Ni 0–0.02, Pb 0–0.04, K 0–0.11, Na 0–0.87, V 0.08–1.14, Ce 0–0.43, La 0–0.36, Nd 0–0.06, Nd 0–0.06, Sm <0.05, Pr <0.05, Nb 0–0.14, and Th 0–0.07. As a result, based on the general formula $ABC_2T_{18}O_{38}$, these potentially new crichtonite-group species can be described by one of four formulae:

1. $(\text{Sr},\text{Na},\text{K},\text{REE})(\text{Ca},\text{Zr},\text{Mn})(\text{Ti},\text{Fe})_4\text{Fe}_2\text{O}_{38}$;
2. $(\text{Sr},\text{Na},\text{K},\text{REE})(\text{Zr},\text{Ca},\text{Mn})(\text{Ti},\text{Fe})_4\text{Fe}_2\text{O}_{38}$;
3. $(\text{Na},\text{Sr},\text{K},\text{REE})(\text{Ca},\text{Zr},\text{Mn})(\text{Ti},\text{Fe})_4\text{Fe}_2\text{O}_{38}$;
4. $(\text{Na},\text{Sr},\text{K},\text{REE})(\text{Zr},\text{Ca},\text{Mn})(\text{Ti},\text{Fe})_4\text{Fe}_2\text{O}_{38}$.

Formulae 1 and 2 correspond to potentially new Ca- or Zr-dominant variants of crichtonite, whereas 3 and 4 correspond to potentially new Ca- or Zr-dominant variants of landauite.

The Sr-Na-REE titanate minerals are associated with fennitized megakamelon 0.2 mm across, in sharp contact with syenite. Locally, these titanates are the principal oxide mineralization. They are associated with perthitic alkali feldspar, albite, nepheline, analcite, andalusite, comendite, topaz, phlogopite, quartz, rutile, ferroan freudenbergite, titanite, manganooan ilmenite, Na-rich phases related to loparite-(Ce), neoborite, monazite-(Ce), and fluorite. Sulfides include pyrrhotite, marca...
site, chalcopyrite, ferroan alabandite, and an unusual wurtzite. The Na-rich composition of these potentially new chrichtonite-group members are related to a high Na-activity associated with intense Na-metasomatism in the albitized area of the Khibina complex. The Cr-rich compositions (up to 1.87 wt% Cr₂O₃) of the chrichtonite-phases suggests that mafic rocks are the most likely protolith for the mineralized megaxenolith and related xenolithic bodies. P.C.P.

NEW DATA

KIRKIITE


Kirkiite was originally described by Moëlo et al. (1985) from a deposit near Kirki (Greece) with a chemical composition of Pb₁₀.0₈Bi₂.₅₅Sb₀.₁₃As₂.₉₁S₁₉. Even with the compositional differences it was described as the natural analog of synthetic kirkiite. The mineral was associated with vurroite, galena, bismuthinite, ferroan alabandite, and an unusual wurtzite. The studied kirkiite is the second occurrence from a deposit near Kirki (Greece) with a chemical composition Pb₁₀.₉₇(Bi₂.₆₁As₃.₃₅)S₁₉. The studied kirkiite is the second occurrence from Vulcano islands, Aeolian archipelago, Italy. It forms as a mixed crust and aggregates of micro crystals covering brecciated and altered rocks. The first specimen described in 1998 gave an average composition of Pb₀.₉₉Bi₂.₅₃Sb₀.₁₁As₂.₉₉S₁₉, whereas the newly described composition gave an average composition of Pb₀.₉₉Bi₂.₅₃Sb₀.₁₁As₂.₉₉S₁₉ based on 35 atoms, which is closer to the ideal formula. The crystals were found to be homogeneous in composition. The main compositional differences between the type and the close-to-ideal kirkiite are the higher Bi content, the absence of Sb and the presence of trace Se and Cl in the later specimen.

The crystal-structure refinement of the close-to-ideal kirkiite was performed by single-crystal X-ray diffraction using Bruker AXS four-circle diffractometer equipped with CCD SMART1000 area detector, on a twinned (0.010 × 0.024 × 0.037 mm) crystal, to R₁ = 0.074 for 1443 reflections with F₀ > 4(Fᵢ). The mineral is pseudo-hexagonal monoclinic, P₂₁/m, a = 8.₇₇₄(3) Å, b = 26.₂₃₇(6) Å, c = 8.₇₇₄(3) Å, V = 1740.2(9) Å³. The c axis is shorter than for the type specimen whereas a and b are longer. These differences are related to a higher Bi/As ratio in the investigated kirkiite, based on the distortion their site occupancy causes on certain polyhedrons. In general the polyhedrons are more symmetrical and regular in the close-to-ideal kirkiite.

The mineral was associated with varroite, galena, bismuthinite, galenobismitite, canniarizite, lillianite, huyrovsykite, and less characterized sulfochlorides. The difference in composition of the two occurrences of kirkiite at Vulcano is due to the differences in the composition of the two occurrences of the gas phase coming from the fumaroles at the moment of crystallization.

ANITMONPEARCEITE*, SE-RICH

M. Evain, L. Bindi, S. Menchetti (2006) Structure and phase transition of the Se-rich variety of antimonpearceite, [(Ag, Cu)₄(Sb,As)₅(S,Se)₇]-[Ag₉Cu(S,Se)₂]). Acta Crystallogr., B62, 768–774.

Single-crystal X-ray structure study of Se-rich antimonpearceite, (Ag,Cu)₄(Sb,As)₅(S,Se)₇, at 300 and 120 K (R₁ = 0.049 for the refinement at 300 K, R₁ = 0.069 at 120 K), indicated that at room temperature it is isotopic with pearceite: trigonal, space group P₆₃/m1, with cell parameters (at 300 K) a = 7.₅₉₅₀(₄), c = 12.₀₇₃₁(₆) Å, V = 603.₁₂(₅) Å³, Z = 1, Dₐth = 6.₅₂ g/cm³. The average of ten electron microprobe analyses yielded the chemical formula on the basis of 29 atoms: [Ag₁₄.₅₉Cu₁.₄₁Sb₁.₆₆As₀.₃₄]₁₉[S₈.₄₇Sb₀.₂₉₉S₇.₄₉]₂₁.₂₂, in fair agreement with that derived from the structural analysis at 300 K: (Ag₁₄.₅₉Cu₁.₄₁Sb₁.₆₆As₀.₃₄)₂₈[S₈.₄₇Sb₀.₂₉₉S₇.₄₉]₂₁.₂₂. Aside from Se vs. As content, the room temperature structure of Se-rich antimonpearceite differs from that of pearceite (cf. American Mineralogist, 91, 1953–1954) mainly in the ordering of Se onto certain anion sites. In contrast to pearceite, Se-rich antimonpearceite undergoes a phase transition at low temperatures to a structural variant not previously observed in the polybasite group: monoclinic, space group P₂₁/c, a = 13.₁₄₂₆(1₄), b = 7.₅₈₇₉(₇), c = 2₃.₇₂₉₄(₄) Å, α = 90°, β = 90°, γ = 90°. A.J.L.

BILLIETITE*


Single-crystal X-ray study of billietite (R₁ = 0.0₃₄), Ba[(UO₂)₆O₄(OH)₆](H₂O)₈, confirmed that it is orthorhombic, space group Pbn₂, (non-standard setting of space group Pnma), a = 12.₀₉₄₁(₈), b = 3₁.₂₁₁₂(₂), c = 7.₁₅₆₃(₅) Å, V = 2₆₄₁.₇₄(₇) Å³, Z = ₄, Dₐth = 5.₂₅ g/cm³. The crystal studied was twinned by inversion with a highly asymmetric distribution of the enantiomorphic components: twin-scale factor 6(1)%. Billietite contains two symptomatically and stereochemically distinct structural sheets of uranyl polyhedra; one sheet is identical to that found in ianthinite, whereas the other is topologically identical to that found in becquerelite. The sheets are linked by Ba cations and H₂O groups. The data resolve previous uncertainties about the structure and composition of billietite. A.J.L.

LÉVYCLAUDITE*


Single-crystal X-ray study of an untwinned crystal of the Eu₁₀.₀₈Bi₂.₅₅Sb₀.₁₁As₂.₉₁S₁₉, Z = ₂, Dₐth = 5.₇₁ g/cm³, has shown that it is a misfit-layer compound of the cylindrite type, with a structure that results from the combination of two heavily modulated triclinic Q and H subcells with a common q wave-vector and only one shared reciprocal axis (stacking direction). The Q layer, ~(Pb₃.₀₃Sb₀.₂₃S), is derived from the NaCl archetype: a = 5.₈₂₁₈(₆), b = 5.₈₆₄₅(₅), e = 1₂.₁₄₄₃(₁₃) Å, α = 9₂.₃₂₇₇(₇), β = 7₈.₅₃₃₉(₉), γ = 9₀.₀₁₉₈(₈)°, the H layer, ~(Sn₉.₅₆Cu₀.₅S₂), is

NEW MINERAL NAMES
derived from the CdI₂ archetype: \(a = 3.6661(3), b = 6.3138(5), c = 11.9028(10) \text{ Å}, \alpha = 92.490(7), \beta = 90.590(8), \gamma = 89.986(8)\)°. The structure was refined with a superspace approach that accounts for the modulations in the two subsystems and uses the non-standard triclinic space group \(\text{C \tilde{T}}\).

**Discussion.** As the material studied is synthetic in origin, the use of the suffix –(Sb) for the composition \((\text{Pb}\,_{0.701}\text{Sb}\,_{0.299}\text{S})_{1.357}(\text{Sn}\,_{0.851}\text{Cu}\,_{0.299}\text{S}_2)\) is in accord with the recommendations of the IMA for chemical analogs of minerals (cf. Bayliss et al. 2005, *Canadian Mineralogist*, 43, 1429–1433). The composition of natural lévyclaudite expressed in a similar fashion is: \((\text{Pb}\,_{0.72}\text{Bi}\,_{0.22}\text{Sb}\,_{0.06}\text{S})_{1.36}(\text{Sn}\,_{0.80}\text{Cu}\,_{0.35}\text{S}_2)\). A.J.L.

---

**Tychite**


Single-crystal X-ray study of tychite \((R1 = 0.023), \text{Na}_6\text{Mg}_2(\text{SO}_4)(\text{CO}_3)_4\), confirmed that it is isotypic with ferrotychite and a member of the northupite group: cubic, space group \(Fd\bar{3}, a = 13.9038(2) \text{ Å}, V = 2687.82(7) \text{ Å}^3, Z = 8, D_{\text{calc}} = 2.58 \text{ g/cm}^3\). A Raman spectrum of tychite with peak assignments is also presented. A.J.L.