New Mineral Names*

Ralph Rowe, Arianne Petley-Ragan, and Paula C. Piilonen†

Mineral Sciences Division, Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, Ontario K1P 6P4, Canada

Capranicaite*

A.M. Callegari, M. Boiocchi, F. Bellatreccia, E. Caprilli, O. Medenbach, and A. Cavallo (2011) Capranicaite, $(K,\square)$ $(Ca,Na)Al_4B_4Si_2O_{18}$: a new inosilicate from Capranica, Italy, with a peculiar topology of the periodic single chain $[Si_2O_6]$. Mineral. Mag., 75, 33–43.

Capranicaite forms as clear, vitreous crystals of up to 0.1 mm in size inside miarolitic cavities in a feldspathoid-bearing syenite block from the Vico volcanic complex in Capranicaite, Viterbo Province, Italy. It is found associated with K-feldspars, plagioclase, andradite, hornblende, biotite, magnetite, sodalite-haüyne series mineral, titanite, apatite, zircon, and a B-Be-Si phase. It exhibits a good cleavage on {001}, a splintery fracture, and its hardness could not be measure but is assumed to be less than 6. $D_{calc} = 2.41$ g/cm^3. The mineral is not fluorescent under short and long UV-light and has a white streak. The new species is biaxial (–), $\alpha = 1.495(1)$, $\beta = 1.543(1)$, $\gamma = 1.544(1)$, $2V_{meas} = 7.3(2)°$, $2V_{calc} = 16°$, and optical orientation is $\alpha \sim \parallel c$, $\beta \sim \parallel a$, $\gamma \parallel b$, and the optical plan is (100). Capranicaite does not show any pleochroism.

Electron microprobe analyses (average of four analyses) gave SiO_2 20.70, Al_2O_3 32.91, B_2O_3 22.90, K_2O 5.36, CaO 11.04, Na_2O 4.08, Cs_2O 2.20, sum 99.19 wt% corresponding to $(K_{0.69}Cs_{0.10})_{\Sigma0.79}$ $(Ca_{1.19}Na_{0.80})_{\Sigma1.99}Al_{3.91}B_{3.99}Si_{2.09}O_{18}$ based on 18 O atoms, with an ideal formula of $(K,\square)(Ca,Na)Al_4B_4Si_2O_{18}$. The FTIR spectrum shows absorptions from 2289 to 2640 cm^{-1} (BO_3), a broad absorption from 3627 to 3535 cm^{-1} (H_2O/OH molecules), absorption at 1611 cm^{-1} (H_2O) and a small but sharp band at 2341 cm^{-1} (CO_2).

The crystal structure was solved on a platy $0.15 \times 0.11 \times 0.05$ mm crystal using the intensity data collected with a Bruker AXS three-circle diffractometer equipped with a CCD detector, $R_{obs} = 5\%$ for 3399 observed reflections $[F(I)/\sigma(I) \geq 3)]$. Capranicaite is monoclinic, $P2_1/n$, $a = 4.8507(2)$, $b = 16.6156(6)$, $c = 20.5445(7)$ Å, $\beta = 90.245°$, $V = 1655.82(17)$ Å^3, $Z = 4$ (refined from single-crystal data). No X-ray diffraction data were collected due to the small amount of material available, the strongest calculated (Cu$K\alpha$ radiation) diffraction lines are the following $[d_{obs}$ in Å $(I_{obs}\%, hkl)]$: $4.104(90,\overline{1}21,121)$, $3.424(83,006)$, $3.234(100,124,044)$, $3.119(32,\overline{1}41,141)$, $2.647(24,126)$, $2.425(31,200)$, $2.405(37,160)$, $2.342(25,\overline{1}62,162)$, $2.184(38,048,\overline{1}64)$, $1.564(30,2.0.10,\overline{1}.6.10)$. Structur-

ally, capranicaite fits in 09.DB: inosilicates with 2-periodic single chains, Si_2O_6 (pyroxene-related minerals) within the Nickel and Strunz classification. The capranicaite structure has a site that is very weakly charged and usually filled with large cations, but when empty can behave as "zeolitic" channels and host neutral molecules, which explains the presence of water and CO_2 in the FTIR data.

The mineral is name after the type locality. The name and mineral submission (IMA 2009-086) was approved by the IMA CNMNC and holotype material is housed at the Mineralogical Museum of Rome University "La Sapienza" under catalog no. MMUR 33036/1. **R.R.**

Fluorbritholite-(Y)*

I.V. Pekov, N.V. Zubkova, N.V. Chukanov, T.A. Husdal, A.E. Zadov, and D.Y. Pushcharovsky (2011) Fluorbritholite-(Y), $(Y,Ca,Ln)_5[(Si,P)O_4]_3F$, a new mineral of the britholite group. N. Jb. Mineral. Abh., 188, 191–197.

Fluorbritholite-(Y) is a new mineral from Lagmannsvik and Kråkmo, Hamarøy, Nordland, Norway. Both localities are alkaline granite-related pegmatites located within a 1750 Ma partially recrystallized granitic gneiss. At Lagmannsvik, the mineral occurs as irregular grains and hexagonal, tabular crystals up to 1 mm in granular aggregates of Y-bearing fluorite and allanite-(Ce), associated with quartz aluminocerite-(Ce), bastnäsite-(Ce), britholite-(Y), gadolinite-(Y), hundholmenite-(Y), minerals of the thalénite-(Y)-fluorthalénite-(Y) series, kainosite-(Y), and tengerite-(Y). At Kråkmo, the mineral forms rims up to 0.5 mm thick around fluorapatite crystals that are embedded in quartz, fluorite, or allanite-(Ce). Fluorbritholite-(Y) has also been found at Mt. Vyuntspakhk, Western Keivy, Kola Peninsula, Russia, in an amazonite-bearing pegmatite in metasomatically altered gneiss near the contact with alkaline granites. Here it forms single, irregular grains and rarely coarse-grained, hexagonal short-prismatic to thick-tabular crystals up to 2.5×4 cm. Fluorbritholite-(Y) is transparent, light pink-brown to brown-pink, light brown, or dark brown. It has a pale brown to almost white streak, vitreous to greasy luster (metamict samples are resinous), is brittle, has an uneven to conchoidal fracture, Mohs hardness = 5.5, and no cleavage or parting was observed. It has a calculated density of 4.609 g/cm^3. Optically, fluorbritholite-(Y) is uniaxial negative (–), $\omega = 1.784(2)$, $\varepsilon = 1.789(3)$, or anomalously biaxial positive (+), $\alpha = 1.784(2)$, $\beta = 1.784(2)$, $\gamma = 1.789(3)$, $2V_{meas} = 10(5)°$. It is colorless and non-pleochroic. The FTIR spectrum of fluorbritholite-

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(Y) is typical of that for other britholite-group minerals.

The chemical composition of fluorbritholite-(Y) was determined by WDS on a Camebax SX50 electron microprobe. The average (range) of four analyses on the holotype material gave CaO 12.21 (11.3–13.0), MnO 1.06 (0.8–1.2), Y_2O_3 30.80 (29.4–31.7), La_2O_3 1.13 (0.9–1.3), Ce_2O_3 7.12 (6.7–7.9), Pr_2O_3 0.69 (0.5–0.8), Nd_2O_3 6.85 (5.7–7.9), Sm_2O_3 2.15 (1.7–2.9), Gd_2O_3 2.23 (1.8–2.9), Dy_2O_3 2.8 (2.2–3.6), Er_2O_3 2.61 (2.1–3.1), Yb_2O_3 3.75 (3.3–4.2), SiO_2 24.18 (23.8–24.5), P_2O_5 0.29 (0.2–0.4), F 2.01 (1.8–2.3), $O \times (F,Cl)_2$ −0.85, total 99.03 wt%, corresponding to an empirical formula (based on 13 anions) of $[(Y_{2.013}Ce_{0.320}Nd_{0.300}Yb_{0.140}Dy_{0.111}Er_{0.101}Gd_{0.091}Sm_{0.091}La_{0.051}Pr_{0.031})_{\Sigma3.249}Ca_{1.607}Mn_{0.110}]_{\Sigma4.966}[(Si_{2.970}P_{0.030})_{\Sigma3}O_{12}][F_{0.781}O_{0.210}(OH)_{0.009}]_{\Sigma1}$.

Powder X-ray diffraction data for fluorbritholite-(Y) were collected using a STOE STADI MP powder diffractometer ($CuK\alpha_1$ radiation) with a STOE linear position sensitive detector. The strongest lines on the diffraction pattern [d_{obs} in Å (I_{obs}%, hkl)] include 4.104(27,200), 3.160(27,102), 3.102(29,210), 2.826(100,121), 2.775(58,112), 2.737(46,300), 1.948(25,222), and 1.839(28,123), with refined unit-cell parameters of a = 9.464(2), c = 6.845(2) Å, V = 531.0(4) Å^3, Z = 2. Single-crystal X-ray structure data were collected on an Xcalibur S diffractometer with a CCD detector (MoKα radiation). A total of 14 113 reflections were observed, with 474 unique reflections. The structure was refined in space group $P6_3/m$ to $R1$ = 0.0466, $wR2$ = 0.0717 for 461 observed reflections with $F_o > 4\sigma(F_o)$, GoF = 1.309. The mineral is isostructural with fluorapatite.

Both the mineral and named have been approved by the IMA CNMNC (IMA no. 2009-005). The mineral has been named as the fluorine-dominant analogue of britholite-(Y). The holotype specimen has been deposited in the Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow (catalog no. 3762/1). **P.C.P.**

FLUOROLEAKEITE*

F. Cámara, F.C. Hawthorne, N.A. Ball, G. Bekenova, A.V. Stepanov, and P.E. Kotel'nikov (2010) Fluoroleakeite, $NaNa_2(Mg_2Fe_3^{3+}Li)Si_8O_{22}F_2$, a new mineral of the amphibole group from the Verkhnee Espe deposit, Akjailyautas Mountains, Eastern Kazakhstan District, Kazakhstan: description and crystal structure. Mineral. Mag., 74, 521–528.

Fluoroleakite was discovered in the Verknee Espe deposit, Akjailyautas Mountains, Eastern Kazakhstan District, Kazakhstan. It occurs as poorly terminated prisms up to 3 mm in length as single-crystal, small aggregates and as inclusions in the mineral cámarite. It has a splintery fracture, a hardness ~6, D_{calc} = 3.245 g/cm^3, and a perfect cleavage {110} characteristic of monoclinic amphiboles. Optically, fluoroleakite is biaxial (–), indices of refraction α = 1.663(2), β = 1.673(2), γ = 1.680(2), $2V_{meas}$ = 80.9(6)°, $2V_{calc}$ = 79.4°, and optical orientation is $X \wedge a$ = 14.1° (in β obtuse), $Y \| b$, $Z \wedge c$ = 75.9° (in β acute). It shows pleochroism in the following pattern: X = pale gray-green, Y = medium gray, Z = gray-brown. The mineral is black with a light gray to colorless streak and does not fluoresce under short and long-wave UV-light.

The chemistry of fluoroleakeite from a combination of electron microprobe analyses (average of 10 analyses) and structural determination for Li and the Fe^{2+}/Fe^{3+} ratio gave SiO_2 53.34, TiO_2 1.27, Al_2O_3 0.62, V_2O_3 0.05, Fe_2O_3 15.10, FeO 6.0, MnO 2.04, ZnO 0.18, MgO 6.40, CaO 0.13, Na_2O 9.08, K_2O 1.98, Li_2O 1.10, H_2O(calc) 0.16, F 3.33, sum 99.39 wt% corresponding to an empirical formula of $(Na_{0.64}K_{0.38})(Na_{1.98}Ca_{0.02})(Li_{0.66}Mg_{1.42}Fe_{0.75}^{2+}Mn_{0.26}^{2+}Zn_{0.02}Fe_{1.69}^{3+}V_{0.01}^{3+}Ti_{0.14}^{4+}Al_{0.03})(Si_{7.93}Al_{0.07})O_{22}(F_{1.57}OH_{0.16}O_{0.27})$ based on 23 O atoms. The ideal formula is $NaNa_2(Mg_2Fe_2^{3+}Li)Si_8O_{22}F_2$.

The structure was solved on a $25 \times 200 \times 300$ μm crystal using a Bruker AXS diffractometer equipped with a SMART APREX CCD detector to R_{obs} = 2.4% for 2423 observed reflections [$I_o > 4\sigma(I)$]. Fluoroleakite is monoclinic, $C2/m$, with unit-cell parameters refined to a = 9.8297(3), b = 17.9257(6), c = 5.2969 Å, β = 103.990(1)°, V = 905.7(1) Å^3, Z = 2. The strongest diffraction lines (Gandolfi camera, Ni-filtered CuKα radiation, 17 lines) include [d_{obs} in Å (I_{obs}%, hkl)]: 8.434(40,110), 4.464(30,021), 3.405(30,131), 3.137(20,310), 2.718(100,151), 2.541(20,$\bar{2}$02), 2.166(20,261). The presence of Li in the structure characterizes the leakite-related amphiboles and improved detection methods for light elements such as Li suggest that Li-amphiboles to be more common that previously thought.
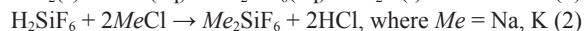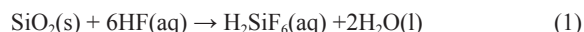
The new mineral takes its name from being the fluorine-dominant analog of the (OH)-dominant end-member mineral leakite. The mineral and its name were approved by the IMA CNMNC (2009-085) and the holotype material has been incorporated to the mineral collection of the Fersman Mineralogical Museum, Moscow, Russia under catalog no. 3828/1. **R.R.**

HEKLAITE*

A. Garavelli, T. Balić-Žunić, D. Mitolo, P. Acquafredda, E. Leonardsen, and S.P. Jakobsson (2010) Heklaite, $KNaSiF_6$, a new fumarolic mineral from Hekla volcano, Iceland. Mineral. Mag., 74, 147–157.

The new mineral heklaite was identified in five specimens collected from fumarols formed by the 1991 eruption of the Hekla central volcano located in the Eastern Volcanic Zone in South Iceland. Heklaite occurs as micrometer to submicrometer glassy, colorless, transparent and non-fluorescent crystals with a white streak. Optical properties, hardness and density were not observed or measured due to the minute crystal size. D_{calc} = 2.69 g/cm^3. It forms closely associated with ralstonite, malladrite, hieratite, and other potentially new mineral phases in fumarolic encrustations and is found intergrown with malladrite and possibly with the cubic polymorph of hieratite.

Analyses with an electron microprobe-EDS (average of five point analyses) gave: Na 11.98, K 18.29, Si 13.91, F 55.66, sum 99.84 wt% corresponding to $Na_{1.063}K_{0.954}Si_{1.010}F_{5.974}$ based on 9 apfu. The ideal formula is $KNaSiF_6$. Heklaite possibly forms through the following reactions caused by F-rich gases being released in fumarols:

$$SiO_2(s) + 6HF(aq) \rightarrow H_2SiF_6(aq) + 2H_2O(l) \quad (1)$$
$$H_2SiF_6 + 2MeCl \rightarrow Me_2SiF_6 + 2HCl, \text{ where } Me = Na, K \quad (2)$$

Solving the structure using single-crystal X-ray data was not attempted due to the small crystal size, but Rietveld refine-

ment was used to confirm that it was the analog of synthetic $KNaSiF_6$ and to refine the unit-cell parameters. Heklaite was established to be orthorhombic *Pnma*, with a = 9.3387(7), b = 5.5032(4), c = 9.7957(8) Å, V = 503.43(7) Å^3, and reliability factors: R_{exp} = 6.17%, R_{wp} = 10.48%, Goodness of Fit = 1.70, and R_{bragg} = 6.43%. Powder diffraction data were collected using a PanAlytical PW3710 diffractometer with Bragg-Brentano geometry (Cu-anode, secondary graphite monochromator). The strongest measured diffraction peaks for heklaite are [d_{obs} in Å (I_{obs}%, *hkl*)]: 4.88(20,002), 4.33(53,102), 4.26(56,111), 3.40(49,112), 3.37(47,202), 3.34(100,211), 2.301(27,221), 2.251(27,303), 2.050(52,123), 2.016(29,321), 1.923(20,304), 1.918(22,223). The structure-types of silicofluorides are characterized by SiF_6 octahedra but are also controlled by the difference in coordination of Na, K, and NH_4, making their respective structures significantly different. Given the structural differences between $KNaSiF_6$ (orthorhombic), K_2SiF_6 (cubic), and Na_2SiF_6 (pseudo-trigonal), it is unlikely that significant solid solution exists within this system.

The mineral is named after the type locality, the Hekla volcano in Iceland. Both the mineral and names have been approved by the IMA CNMNC (IMA 2008-52). Holotype specimen was deposited at the Icelandic Institute of Natural History, Reykjavik, Iceland (catalog no. NI 15513). **R.R.**

HERMANNROSEITE*

J. Schlüter, D. Pohl, and G. Gebhard (2011) The new mineral hermannroseite, $CaCu(PO_4,AsO_4)(OH)$, the phosphate analogue of conichalcite, from Tsumeb, Namibia. N. Jb. Mineral. Abh., 188, 135–140.

In the 1960s, a phosphate analog of conichalcite was found in the Tsumeb Mine, Tsumeb, Namibia. Only one sample of hermannroseite was discovered. The entire sample was a glassy green botryoidal composite lining a cavity. The composite contained conichalcite, hermannroseite, whitlockite, pseudomalachite, and hydroxylapatite colored black by manganese oxides. The grain size varied for all minerals from microcrystalline to medium grained (3 mm). The mean grain size of 0.7 μm made the new mineral difficult to study. Hermannroseite is grassy green with a pale green streak; its crystals are transparent and have a vitreous luster. Cleavage was not observed and hardness could not be measured. Density and mean refractive index were calculated based on the empirical formula and unit-cell data: 4.08 g/cm^3, 1.77, respectively. Hermannroseite should be biaxial. Pleochroism was not observed but should be similar to that of conichalcite; yellow-green to emerald green to blue-green.

Quantitative electron microprobe analysis by CAMECA SX 100 gave an average (150 analyses) of CaO 22.80, CuO 34.52, ZnO 0.58, P_2O_5 15.16, As_2O_5 21.88, V_2O_5 1.02, H_2O (by difference) 4.04, total 100.00 wt% giving an empirical formula, based on five O atoms pfu, of $Ca_{0.96}(Cu_{1.03}Zn_{0.02})_{\Sigma1.05}(P_{0.51}As_{0.45}V_{0.03})_{\Sigma0.99}O_{3.94}(OH)_{1.06}$ for all analyses. Analyses with higher P contents give an empirical formula of $Ca_{0.96}(Cu_{0.99}Zn_{0.01})_{\Sigma1.00}(P_{0.64}As_{0.30}V_{0.01})_{\Sigma0.95}O_{3.68}(OH)_{1.32}$. The simplified formula for hermannroseite is $CaCu(PO_4,AsO_4)(OH)$; the ideal end-member formula is $CaCuPO_4(OH)$. An X-ray powder diffraction pattern (Stoe STADI P powder diffractometer, $CuK\alpha_1$ radiation, 42 lines given) include the strongest lines [$d_{obs}(I_{obs},hkl)$]: 5.710(56,110), 4.057(37,111), 3.663(21,200), 3.092(63,201), 2.854(29,220), 2.808(100,130), 2.571(73,112), 2.525(36,131). The powder was a mixture of apatite, conichalcite, hermannroseite, and whitlockite. Hermannroseite is isostructural with conichalcite, therefore orthorhombic; its unit-cell parameters are a = 7.328(7), b = 9.123(7), c = 5.769(6) Å, V = 385.7(6) Å^3, and Z = 4 with space group $P2_12_12_1$.

The mineral and name have been approved by the IMA CNMMN. Hermannroseite was collected by Bruno Geier in the 1960s. The original sample (no. 16862) was passed from one of Geier's heirs to Georg Gebhard to be studied. It is named in honor of mineralogist Professor Dr. Hermann Rose (1883–1976), honorary member of the German Mineralogical Society since 1973 and head of the Mineralogical Institute at the University of Hamburg (1922–1954). The holotype specimen (TS 637) is deposited in the Mineralogical Museum's collection, University of Hamburg, Germany. **A.P.-R.**