Zinkgruvanite $Ba_4Mn^{2+}{}_4Fe^{3+}{}_2(Si_2O_7)_2(SO_4)_2O_2(OH)_2$

Crystal Data: Triclinic. *Point Group*: $\bar{1}$. As subhedral to euhedral platy crystals to 4 mm, flattened on {001} and elongated along [100].

Physical Properties: *Cleavage*: Perfect on {001}, good on {110}. *Tenacity*: Brittle. *Fracture*: Uneven. Hardness = ~4.5 VHN = 488-616, 539 average (100 g load). D(calc.) = 4.42(1)

Optical Properties: Semi-opaque to translucent. *Luster*: Vitreous to subadamantine (crystal faces), resinous (fractures). *Color*: Almost black, reddish black (thin fragments). *Streak*: Dark brown. *Optical Class*: Biaxial (+). *n*(calc.) = 1.79 $2V_z > 70°$ *Pleochroism*: Strong, deep brown-red ($E \perp$ {001} cleavage) to olive pale brown. *Dispersion*: Strong, $r > v$.
R_2-R_1: (470) 8.21-8.07, (546) 7.98-7.79, (589) 7.87-7.68, (650) 7.80-7.65

Cell Data: *Space Group: P*$\bar{1}$. a = 5.3982(1) b = 7.0237(1) c = 14.8108(4) α = 98.256(2)° β = 93.379(2)° γ = 89.985(2)° Z = 1

X-Ray Diffraction Pattern: Zinkgruvan mine, near Åmmeberg, Örebro County, Sweden.
2.125 (100), 2.107 (96), 2.680 (85), 2.699 (71), 3.508 (70), 2.980 (70), 2.777 (70)

Chemistry:

	(1)	(2)		(1)	(2)
SiO_2	17.38	16.29	MgO	0.37	
TiO_2	1.05		CaO	0.39	
Al_2O_3	0.20		Na_2O	0.07	
Cr_2O_3	0.01		K_2O	0.01	
FeO	[7.53]		BaO	41.26	41.58
Fe_2O_3	[11.56]	10.83	F	0.10	
MnO	8.49	19.23	Cl	0.70	
ZnO	0.03		SO_3	8.63	10.85
NiO	0.03		H_2O	[0.99]	1.22
V_2O_5	0.03		-O = Cl and F	0.20	.
P_2O_5	0.31		Total		100.00

(1) Zinkgruvan mine, near Åmmeberg, Örebro County, Sweden; average electron microprobe analysis supplemented by Raman spectroscopy, H_2O calculated, total Fe partitioned to Fe^{2+}/Fe^{3+} by Mössbauer spectroscopy; corresponds to $(Ba_{4.02}Na_{0.03})_{\Sigma=4.05}(Mn_{1.79}Fe^{2+}{}_{1.56}Fe^{3+}{}_{0.42}Mg_{0.14}Ca_{0.10}Ni_{0.01}Zn_{0.01})_{\Sigma=4.03}(Fe^{3+}{}_{1.74}Ti_{0.20}Al_{0.06})_{\Sigma=2.00}Si_4(S_{1.61}Si_{0.32}P_{0.07})_{\Sigma=1.99}O_{24}[(OH)_{1.63}Cl_{0.29}F_{0.08}]_{\Sigma=2.00}$.
(2) $Ba_4Mn^{2+}{}_4Fe^{3+}{}_2(Si_2O_7)_2(SO_4)_2O_2(OH)_2$.

Mineral Group: Ericssonite group.

Occurrence: From a metamorphosed, stratiform, sphalerite and galena-dominated deposit in a succession of interbedded metatuffite, marble, and skarn. Likely syngenetic-exhalative in origin.

Association: Barytocalcite, diopside, baryte, cerchiaraite-Al, cerchiaraite-Fe, witherite, galena, sphalerite, cubanite, chalcopyrite, pyrrhotite, pyrite, zhangpeishanite.

Distribution: From drill core (from ~530 m depth) at the Zinkgruvan mine, near Åmmeberg, municipality of Askersund, Örebro County, Sweden.

Name: For the type locality, the *Zinkgruvan* mine, Sweden.

Type Material: Department of Geosciences, Swedish Museum of Natural History, Stockholm, Sweden (GEO-NRM 20170502).

References: (1) Cámara, F., D. Holtstam, N. Jansson, E. Jonsson, A. Karlsson, J. Langhof, J. Majka, and A. Zetterqvist (2021) Zinkgruvanite, $Ba_4Mn^{2+}{}_4Fe^{3+}{}_2(Si_2O_7)_2(SO_4)_2O_2(OH)_2$, a new ericssonite-group mineral from the Zinkgruvan Zn-Pb-Ag-Cu deposit, Askersund, Örebro County, Sweden. Eur. J. Mineral., 33, 659-673.