Zhanghuifenite $Na_3Mn^{2+}_4Mg_2Al(PO_4)_6$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. Massive in irregular veinlets or patches, 5 mm thick, in a nodule of beusite interlaminated with lithiophilite. Broken pieces of zhanghuifenite are blocky or tabular. Single crystals to 0.8 mm.

Physical Properties: *Cleavage*: Good on {010}. *Tenacity*: Brittle. *Fracture*: n.d. Hardness = ~5 D(meas.) = 3.63(2) D(calc.) = 3.62

Optical Properties: Transparent. *Color*: Deep jade-green. *Streak*: Pale green. *Luster*: Vitreous. *Optical Class*: Biaxial (+). α = 1.675(2) β = 1.680(2) γ = 1.690(2) 2V(meas.) = 74(2)° 2V(calc.) = 71° *Orientation*: $\alpha \wedge X = 8°$, $\beta = Y$. *Pleochroism*: *X* = deep blue green, *Y* = pale green, *Z* = yellowish-green. *Absorption*: *X* > *Y* > *Z*. *Dispersion*: Very strong, *r* >> *v*.

Cell Data: *Space Group*: $P2_1/n$. a = 12.8926(3) b = 12.4658(3) c = 10.9178(2) β = 97.9200(10)° Z = 4

X-ray Powder Pattern: Santa Ana mine, San Luis province, Argentina. (similar to qingheiite) 2.697 (100), 2.527 (34), 2.877 (25), 6.201 (21), 2.096 (14), 1.742 (14), 3.445 (13)

Chemistry:

	(1)
P_2O_5	45.21
Al_2O_3	4.36
Fe_2O_3	1.58
MgO	7.14
MnO	23.15
FeO	8.84
CaO	0.66
Na_2O	9.19
Total	100.13

(1) Santa Ana mine, San Luis province, Argentina; electron microprobe analysis supplemented by Raman spectroscopy, Fe^{2+}/Fe^{3+} ratio adjusted for electroneutrality; corresponding to $(Na_{2.80}Ca_{0.11})_{\Sigma=2.91}(Mn^{2+}_{3.09}Fe^{2+}_{0.47}Mg_{0.36})_{\Sigma=3.92}(Mg_{1.31}Fe^{2+}_{0.69})_{\Sigma=2.00}(Al_{0.81}Fe^{3+}_{0.19})(PO_4)_6$.

Mineral Group: Alluaudite supergroup.

Occurrence: Attributed to veining, produced possibly by a late-stage, fluid-rich peraluminous melt in a zoned granitic pegmatite.

Association: Beusite, lithiophilite.

Distribution: At the Santa Ana mine, San Luis province, Argentina [TL].

Name: Honors Chinese mineralogist, Professor *Huifen Zhang* (1934-2012), Institutes of Geochemistry in Guiyang and Guangzhou, China.

Type Material: University of Arizona Mineral Museum (21321) and the RRUFF Project (R160030), Tucson, Arizona, USA.

References: (1) Yang, H., A. Kobsch, X. Gu, R.T. Downs, and X. Xie (2021) Zhanghuifenite, $Na_3Mn^{2+}_4Mg_2Al(PO_4)_6$, a new mineral isostructural with bobfergusonite, from the Santa Ana mine, San Luis province, Argentina. Amer. Mineral., 106, 1009-1015.