Clino-suenoite $\square Mn^{2+}_2Mg_5Si_8O_{22}(OH)_2$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As fibrous aggregates and as flattened elongated crystals, often in tufts to 2 cm.

Physical Properties: *Cleavage*: Perfect on {110} (by analogy to group). *Fracture*: n.d. *Tenacity*: Brittle (by analogy to group). Hardness = n.d. D(meas.) = n.d. D(calc.) = 3.175

Optical Properties: Transparent to translucent. *Color*: Yellow, honey-yellow, yellow-brown to light brown. *Streak*: n.d. *Luster*: Vitreous.
Optical Class: Biaxial (+). $\alpha = 1.632(2)$ $\beta = 1.644(2)$ $\gamma = 1.664(2)$ 2V(meas.) = 78(2)° 2V(calc.) = 76.3° *Pleochroism*: *X* = pale yellow to yellow, *Y* = yellow to pale orange, *Z* = orange-brown. *Dispersion*: *v* < *r*, weak. *Orientation*: $X \wedge a = 15°$ (in β obtuse), $Y \parallel b$, $Z \wedge c = 2°$ (in β acute).

Cell Data: Space Group: *C*2/*m*. $a = 9.6128(11)$ $b = 18.073(2)$ $c = 5.3073(6)$ $\beta = 102.825(2)°$ Z = 2

X-ray Powder Pattern: Lower Scerscen Glacier, Valmalenco, Sondrio, Italy.
2.728 (100), 2.513 (77), 3.079 (62), 8.321 (60), 3.421 (54), 2.603 (42), 2.175 (42)

Chemistry:	(1)	(2)		(1)	(2)
Na_2O	0.70		Fe_2O_3	[0.75]	
K_2O	0.01		Al_2O_3	0.22	
CaO	1.65		SiO_2	54.95	57.08
MgO	19.40	23.93	F	0.14	
ZnO	0.10		Cl	0.01	
NiO	0.12		H_2O	[1.80]	2.14
MnO	17.81	16.85	-O = (F, Cl)	0.06	.
FeO	[0.32]		Total	97.93	100.00

(1) Lower Scerscen Glacier, Valmalenco, Sondrio, Italy; average of 10 electron microprobe analyses supplemented by Raman spectroscopy, FeO and Fe_2O_3 apportioned by electroneutrality, H_2O calculated; corresponds to $^{A}Na_{0.04}{}^{B}(Mn^{2+}_{1.58}Ca_{0.26}Na_{0.16})_{\Sigma=2.00}{}^{C}(Mg_{4.21}Mn^{2+}_{0.61}Zn_{0.01}Ni_{0.01}Fe^{3+}_{0.08}Al_{0.04})_{\Sigma=5.00}{}^{T}Si_{8.00}O_{22}{}^{W}[(OH)_{1.94}F_{0.06}]_{\Sigma=2.00}$. (2) $\square Mn^{2+}_2Mg_5Si_8O_{22}(OH)_2$.

Polymorphism & Series: Can form a continuous series with cummingtonite and grunerite.

Mineral Group: Amphibole supergroup, magnesium-iron-manganese group.

Occurrence: In Mn-rich quartzite glacial erratics derived from metamorphosed marine radiolaritic sediments.

Association: Braunite, rhodonite, spessartine, tiragalloite, pyrophanite.

Distribution: At the Lower Scerscen Glacier, Valmalenco, Sondrio, Italy.

Name: The rootname *suenoite* indicates an amphibole with composition expressed as $^{A}\square{}^{B}Mn^{2+}_2{}^{C}Mg_5{}^{T}Si_8O_{22}{}^{W}(OH)_2$ and the prefix *clino* indicates a monoclinic structure.

Type Material: Mineralogical Museum, University of Pavia, Lombardy, Italy (2016-01).

References: (1) Oberti, R., M. Boiocchi, F.C. Hawthorne, M.E. Ciriotti, O. Revheim, and R. Bracco (2018) Clino-suenoite, a newly approved magnesium-iron-manganese amphibole from Valmalenco, Sondrio, Italy. Mineral. Mag., 82(1), 189-198. (2) (2019) Amer. Mineral., 104(5), 780-781 (abs. ref. 1). (3) Hawthorne, F.C., R. Oberti, G.E. Harlow, W.V. Maresch, R.F. Martin, J.C. Schumacher, and M.D. Welch, (2012) Nomenclature of the amphibole supergroup. Amer. Mineral., 97, 2031-2048.