Nissonite $Cu_2Mg_2(PO_4)_2(OH)_2 \cdot 5H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Rare crystals are tabular on {100}, elongated along [001], diamond-shaped, to 2 mm, showing {001}, {100}, {$\overline{1}$11}; more commonly in aggregates and thin crusts.

Physical Properties: *Cleavage:* {100}, fair. Hardness = 2.5 D(meas.) = 2.73(1) D(calc.) = 2.782

Optical Properties: Semitransparent. *Color:* Bluish green to deep blue, turquoise-blue. *Optical Class:* Biaxial (–). *Pleochroism:* X = colorless; $Y = Z$ = turquoise-blue. *Orientation:* $Z = b$; $X \wedge a = 15°$; $Y \wedge c = 6°$. *Dispersion:* $r > v$, very strong. $\alpha = 1.584(2)$ $\beta = 1.620(2)$ $\gamma = 1.621(2)$ 2V(meas.) = n.d. 2V(calc.) = 19°

Cell Data: *Space Group:* $C2/c$. $a = 22.523(5)$ $b = 5.015(2)$ $c = 10.506(3)$ $\beta = 99.62(2)°$ Z = 4

X-ray Powder Pattern: Panoche Valley, California, USA.
10.8 (100), 2.768 (100), 4.36 (70), 2.218 (65), 2.679 (60), 3.72 (55), 2.531 (55)

Chemistry:

	(1)	(2)
P_2O_5	27.1	28.98
V_2O_5	0.2	
FeO	0.04	
CuO	32.2	32.49
MgO	15.8	16.46
H_2O^+	16.8	
H_2O^-	5.6	
H_2O		22.07
insol.	1.4	
Total	99.14	100.00

(1) Panoche Valley, California, USA; insoluble is barite. (2) $Cu_2Mg_2(PO_4)_2(OH)_2 \cdot 5H_2O$.

Occurrence: A very rare mineral in a copper prospect (Panoche Valley, California, USA); in a Precambrian sedimentary iron deposit (Iron Monarch quarry, Australia).

Association: Malachite, azurite, libethenite, turquoise, chrysocolla, cuprite, barite, calcite, gypsum, riebeckite (Panoche Valley, California, USA); malachite, calcite, hematite, quartz (Iron Monarch quarry, Australia); turquoise, libethenite (Mt. Oxide, Australia).

Distribution: From a small copper prospect [Llanada copper mine, 6.5 km north-northeast of Llanada] in the Panoche Valley, San Benito Co., California, USA. At the Mt. Oxide copper mine, 150 km north of Mt. Isa, Queensland, and as fine crystals from the Iron Monarch quarry, Iron Knob, South Australia.

Name: To honor William H. Nisson (1912–1965), amateur mineralogist, mineral collector and dealer, of Petaluma, California, USA, who first noted the mineral.

Type Material: n.d.

References: (1) Mrose, M.E., R. Meyrowitz, J.T. Alfors, and C.W. Chesterman (1966) Nissonite, $CuMg(PO_4)(OH) \cdot 2.5H_2O$, a new hydrous copper magnesium phosphate mineral from the Panoche Valley, California. Geol. Soc. Amer. Annual Meeting Abs. with Prog., 145–146 (abs.). (2) (1967) Amer. Mineral., 52, 927 (abs. ref. 1). (3) Groat, L.A. and F.C. Hawthorne (1990) The crystal structure of nissonite. Amer. Mineral., 75, 1170–1175. (4) Bayliss, P. (1986) X-ray powder diffraction for nissonite and waylandite. Powder Diffraction, 1(4), 331–333.