Pickeringite $MgAl_2(SO_4)_4 \cdot 22H_2O$

Crystal Data: Monoclinic. *Point Group:* 2. Acicular to hairlike crystals, with many forms measured although terminated crystals are very rare; in radial or matted aggregates; typically as incrustations and efflorescences.

Physical Properties: *Cleavage:* Poor on {010}. *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = 1.5 D(meas.) = 1.73–1.79 D(calc.) = 1.84 Soluble in H_2O, astringent taste.

Optical Properties: Semitransparent. *Color:* Colorless, white; may be pale shades of yellow, green, or red from metallic impurities; colorless in transmitted light. *Luster:* Vitreous. *Optical Class:* Biaxial (–). *Orientation:* $Y = b$; $Z \wedge a = 36°$. $\alpha = 1.475$ $\beta = 1.480$ $\gamma = 1.483$ 2V(meas.) = 60°

Cell Data: *Space Group:* $P2_1/c$. $a = 6.1844(2)$ $b = 24.2715(9)$ $c = 21.2265(7)$ $\beta = 100.326(4)°$ Z = 4

X-ray Powder Pattern: Tucumcari, New Mexico, USA. (ICDD 12-299).
4.82 (100), 3.510 (90), 4.32 (35), 4.122 (30), 3.791 (30), 6.08 (20), 4.97 (20)

Chemistry:

	(1)	(2)
SO_3	37.84	37.29
Al_2O_3	12.30	11.87
MgO	4.35	4.69
CaO	0.09	
H_2O	44.66	46.15
insol.	0.50	
Total	99.74	100.00

(1) Quetena, Chile. (2) $MgAl_2(SO_4)_4 \cdot 22H_2O$.

Polymorphism & Series: Forms a series with halotrichite.

Mineral Group: Halotrichite group.

Occurrence: A common secondary mineral formed by alteration of pyrite in aluminous rocks or in coal seams; in the oxidized zone of pyritic hydrothermal mineral deposits, typically in arid regions, typically post-mining; a fumarolic product; formed in caves.

Association: Kalinite, alunogen, epsomite, melanterite, copiapite, gypsum.

Distribution: Widespread, so only a few localities are listed. In Chile, abundant from Cerros Pintados, 80 km southeast of Iquique, Tarapacá; at Quetena, west of Calama, and Chuquicamata, Antofagasta. In the USA, in New Mexico, from near Tucumcari, Quay Co.; at The Geysers, Sonoma Co., California; from Alum Point, Salt Lake Co., Utah. In Canada, at Newport, Nova Scotia, and from the junction of the two main branches of the Smoky River, Alberta. In Germany, at Wetzelstein, near Saalfeld, and from near Lehesten, Thuringia. On Valachov Hill, near Skřivaň, Czech Republic. At Cervenica (Opálbánya), Slovakia. In Italy, from Baia di Levante, Vulcano, Lipari Islands; on Mt. Etna, Sicily; and on Elba. At volcanoes on the Kamchatka Peninsula, Russia.

Name: To honor John Pickering (1777–1846), American lawyer and philologist of Boston, Massachusetts, USA.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 523–526. (2) Quartieri, S., M. Triscari, and A. Viani (2000) Crystal structure of the hydrated sulphate pickeringite $MgAl_2(SO_4)_4.22H_2O$: X-ray powder diffraction study. Eur. J. Mineral., 12, 1131–1138.