Minasragrite $V^{4+}O(SO_4)\cdot 5H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Minute equant crystals showing {001}, {110}, {011}, {$\bar{1}$01}, {$\bar{1}$11}; in spherulites and granular masses in delicate efflorescences.

Physical Properties: Hardness = n.d. D(meas.) = 2.03(10) D(calc.) = 2.06 Easily soluble in cold H_2O.

Optical Properties: Semitransparent. *Color:* Vivid cobalt-blue to pale aquamarine-blue; blue in transmitted light. *Luster:* Vitreous.
Optical Class: Biaxial (–). *Pleochroism:* X = deep blue; Y = blue; Z = colorless. *Orientation:* $X = b$; $Z \wedge c$ = small. *Absorption:* $X > Y > Z$. $\alpha = 1.513(2)$ $\beta = 1.536(2)$ $\gamma = 1.545(2)$ 2V(meas.) = Medium large.

Cell Data: *Space Group:* $P2_1/a$. $a = 12.902(4)$ $b = 9.716(5)$ $c = 6.976(2)$ $\beta = 110.90(3)^\circ$ Z = 4

X-ray Powder Pattern: Minasragra, Peru.
5.135 (100), 3.907 (70), 5.431 (60), 3.826 (35), 3.658 (24), 6.049 (20), 3.509 (17)

Chemistry:

	(1)	(2)
SO_3	32.0	31.64
V_2O_5	3.0	
V_2O_4	29.8	32.77
H_2O	34.5	35.59
insol.	0.6	
Total	99.9	100.00

(1) Minasragra, Peru; corresponding to $V_{1.00}O(SO_4)_{1.02}\cdot 4.89H_2O$. (2) $VO(SO_4)\cdot 5H_2O$.

Polymorphism & Series: Dimorphous with orthominasragrite.

Occurrence: An alteration product of patronite in a rich deposit of vanadian materials in fissures that cut red shales and that were probably filled by a remobilized asphaltite deposit (Minasragra, Peru); in a silicified tree, formed as an oxidation product of pyrite reacting with vanadium-rich organic material (Temple Mountain district, Utah, USA).

Association: Patronite, melanterite, morenosite, dwornikite, retgersite, szomolnokite, potassium alum, gypsum (Minasragra, Peru); orthominasragrite, pyrite, sulfur, iron sulfates (Temple Mountain district, Utah, USA).

Distribution: From Minasragra, 46 km from Cerro de Pasco, Peru. At the North Mesa mine group, Temple Mountain district, Emery County, Utah, USA.

Name: For its occurrence at Minasragra, Peru.

Type Material: National Museum of Natural History, Washington, D.C., USA, 87515.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 437–438. (2) Smith, M.L. and J. Marinenko (1973) A reexamination of minasragrite. Amer. Mineral., 58, 531–534. (3) Ballhausen, C.J., B.F. Djurinskij, and K.J. Watson (1968) The polarized absorption spectra of three crystalline polymorphs of $VOSO_4\cdot 5H_2O$. J. Amer. Chem. Soc. 90, 3305–3309. (4) Tachez, M., F. Théobald, K.J. Watson, and R. Mercier (1979) Redétermination de la structure du sulfate de vanadyle pentahydraté $VOSO_4.5H_2O$. Acta Cryst., 35, 1545–1550 (in French with English abs.).