Fernandinite $\mathbf{Ca(V^{5+},V^{4+},Fe^{2+})_8O_{20}\cdot 4H_2O}$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Rare crystals are platy, rectangular, to 10 μm; fibrous, cryptocrystalline, porous massive.

Physical Properties: Hardness = Soft. D(meas.) = 2.78(5) D(calc.) = 3.07 Somewhat soluble in cold H_2O, giving a yellow solution.

Optical Properties: Opaque to translucent. *Color:* Dull green; light green, dark olive-green, brownish green in transmitted light. *Luster:* Submetallic.
Optical Class: Biaxial; strong birefringence. $n = 2.05$ 2V(meas.) = n.d.

Cell Data: *Space Group:* $C2/m$. $a = 11.680(1)$ $b = 3.6537(4)$ $c = 11.023(2)$ $\beta = 105.00(2)^\circ$ Z = [1]

X-ray Powder Pattern: Minasragra, Peru; very close to corvusite.
10.68 (100), 3.483 (26), 1.836 (8), 2.826 (7), 1.949 (6), 3.545 (4), 2.549 (4)

Chemistry:

	(1)	(2)
V_2O_5	83.7	76.6
SiO_2	2.3	1.0
TiO_2	0.17	0.40
Al_2O_3	1.4	0.7
Fe_2O_3	0.5	1.5
CaO	5.6	5.7
Na_2O	0.00	0.04
K_2O	0.2	0.5
H_2O	[6.1]	[13.6]
Total	[100.0]	[100.0]

(1) Minasragra, Peru; by electron microprobe, average of five analyses, all V as V_2O_5, H_2O by difference; assuming Si and Al as impurities, V^{5+}:V^{4+} from crystal-structure analysis, corresponds to $(Ca_{0.86}K_{0.04})_{\Sigma=0.90}(V^{5+}_{6.48}V^{4+}_{1.39}Fe^{2+}_{0.05}Ti_{0.02})_{\Sigma=7.94}O_{20}\cdot 2.5H_2O$. (2) Do.; by electron microprobe, average of 10 analyses, all V as V_2O_5, H_2O by difference; V^{5+}:V^{4+} from crystal-structure analysis, corresponds to $(Ca_{0.92}K_{0.04}Na_{0.01})_{\Sigma=0.97}(V^{5+}_{6.73}V^{4+}_{0.88}Fe^{2+}_{0.34}Ti_{0.05})_{\Sigma=8.00}O_{20}\cdot 4.5H_2O$.

Occurrence: In a rich vanadium deposit in fissures that cut red shales and that were probably filled by a remobilized asphaltite deposit.

Association: Hewettite, quartz.

Distribution: From Minasragra, 46 km from Cerro de Pasco, Peru. In the USA, at the Monument No. 2 mine, Monument Valley, Apache Co., Arizona; from the Cactus Rat mine group, Yellow Cat district, 24 km southeast of Thompson, Grand Co., Utah; in the Spring Creek Mesa area, Uravan district, Montrose Co., Colorado.

Name: For Eulagio E. Fernandini, formerly an owner of the Minasragra, Peru deposit.

Type Material: Harvard University, Cambridge, Massachusetts, 101718; National Museum of Natural History, Washington, D.C., USA, 87661, R5706.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 1062. (2) Evans, H.T., Jr. and J.M. Hughes (1990) Crystal chemistry of the natural vanadium bronzes. Amer. Mineral., 75, 508–521, esp. 516–517. (3) Evans, H.T., Jr., J.E. Post, D.R. Ross, and J.A. Nelen (1994) The crystal structure and crystal chemistry of fernandinite and corvusite. Can. Mineral., 32, 339–351.