Howardevansite $NaCuFe_2^{3+}(VO_4)_3$

Crystal Data: Triclinic. *Point Group:* $\overline{1}$. As tabular crystals with dominant forms {100}, {010}, {001}, {$1\overline{1}0$}, {101}, {$\overline{1}01$}, and {$0\overline{1}1$}, to 80 μm.

Physical Properties: *Tenacity:* Brittle. Hardness = n.d. D(meas.) = n.d. D(calc.) = 3.814

Optical Properties: Opaque, translucent on thin edges. *Color:* Black; deep red-brown through thin edges; medium gray in reflected light. *Streak:* Red-brown. *Luster:* Metallic. *Optical Class:* Biaxial. *Anisotropism:* Moderate.
R_1–R_2: (481) 15.5–20.1, (547) 15.0–18.4, (591) 14.1–17.2, (644) 13.5–17.1

Cell Data: *Space Group:* $P\overline{1}$. $a = 8.198(2)$ $b = 9.773(1)$ $c = 6.6510(8)$ $\alpha = 103.82(1)°$ $\beta = 101.99(1)°$ $\gamma = 106.74(1)°$ Z = 2

X-ray Powder Pattern: Izalco volcano, El Salvador.
3.167 (100), 3.093 (100), 1.659 (70), 3.27 (60), 2.676 (60), 2.603 (60), 1.433 (60)

Chemistry:

	(1)	(2)
V_2O_5	49.17	50.24
TiO_2	0.80	
Al_2O_3	2.01	
Fe_2O_3	23.92	29.40
Mn_2O_3	0.73	
CuO	17.29	14.65
Na_2O	5.6	5.71
K_2O	0.60	
Total	100.12	100.00

(1) Izalco volcano, El Salvador; by electron microprobe, average of 30 analyses, total Fe as Fe_2O_3, total Mn as Mn_2O_3; corresponding to $(Na_{0.98}K_{0.07})_{\Sigma=1.05}Cu_{1.06}(Fe_{1.63}Al_{0.21}Cu_{0.12}Mn_{0.05}Ti_{0.05})_{\Sigma=2.06}(V_{0.98}O_4)_3$. (2) $NaCuFe_2(VO_4)_3$.

Occurrence: Forms by sublimation around fumaroles on an andesitic volcano.

Association: Thenardite, lyonsite.

Distribution: Occurs on the Izalco volcano, El Salvador.

Name: Honors Dr. Howard Tasker Evans, Jr. (1919–2000), American mineralogist and crystallographer, U.S. Geological Survey, Reston, Virginia, USA.

Type Material: Harvard University, Cambridge, Massachusetts, 130752; National Museum of Natural History, Washington, D.C., USA, 165494.

References: (1) Hughes, J.M., J.W. Drexler, C.F. Campana, and M.L. Malinconico (1988) Howardevansite, $NaCu^{2+}Fe_2^{3+}(VO_4)_3^{3-}$, a new fumarolic sublimate from Izalco volcano, El Salvador: descriptive mineralogy and crystal structure. Amer. Mineral., 73, 181–186.