Bannermanite $(Na, K)_x V_x^{4+} V_{6-x}^{5+} O_{15}$ (x = 0.7)

Crystal Data: Monoclinic. *Point Group:* $2/m$. As incrustations of subhedral to euhedral lathlike crystals, flattened on {001} and elongated along [010], up to 250 μm.

Physical Properties: *Cleavage:* {100}, perfect; {010}, fair. *Tenacity:* Brittle. Hardness = n.d. D(meas.) = 3.5(2) D(calc.) = 3.55

Optical Properties: Opaque, transparent on thin edges. *Color:* Black; light brown on thin edges in transmitted light. *Streak:* Dark gray-black. *Luster:* Submetallic. *Optical Class:* Biaxial. *Orientation:* [010] $\parallel$ Y or Z; length-slow. *Absorption:* $Y > X$ or $Z > X$. n = [2.2] (rule of Gladstone and Dale).

Cell Data: *Space Group:* $C2/m$. $a = 15.413(7)$ $b = 3.615(2)$ $c = 10.066(8)$ $\beta = 109.29(8)^\circ$ Z = 2

X-ray Powder Pattern: Izalco volcano, El Salvador. (ICDD 35-713).
7.24 (100), 3.367 (100), 3.068 (80), 2.911 (80), 9.47 (70), 3.491 (70), 2.725 (60)

Chemistry:

	(1)
V_2O_5	95.98
Na_2O	3.03
K_2O	1.26
Total	100.27

(1) Izalco volcano, El Salvador; by electron microprobe, average of six analyses, V^{4+}:V^{5+} from charge balance; corresponds to $(Na_{0.56}K_{0.15})_{\Sigma=0.71}V_{0.71}^{4+}V_{5.29}^{5+}O_{15}$.

Occurrence: In vanadium-bearing sublimates in fumaroles on a basaltic volcanic cone.

Association: Shcherbinaite, stoiberite, ziesite, fingerite, chalcocyanite, chalcanthite.

Distribution: From Izalco volcano, El Salvador.

Name: To honor Dr. Harold MacColl Bannerman (1897–1976), American economic geologist, U.S. Geological Survey and Dartmouth College, Hanover, New Hampshire, USA.

Type Material: Department of Earth Sciences, Dartmouth College, Hanover, New Hampshire; Harvard University, Cambridge, Massachusetts, 126482; National Museum of Natural History, Washington, D.C., USA, 148832, 160385.

References: (1) Hughes, J.M. and L.W. Finger (1983) Bannermanite, a new sodium-potassium vanadate isostructural with β–$Na_xV_6O_{15}$. Amer. Mineral., 68, 634–641. (2) Evans, H.T., Jr. and J.M. Hughes (1990) Crystal chemistry of the natural vanadium bronzes. Amer. Mineral., 75, 508–521, esp. 511–512, 519.