

Brackebuschite

$\text{Pb}_2(\text{Mn}^{3+}, \text{Fe}^{3+})(\text{VO}_4)_2(\text{OH})$

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Crystal Data: Monoclinic. *Point Group:* $2/m$. Typically as acicular crystals, elongated and striated \parallel [010], may be lathlike or wedge-shaped, flattened on {001}, with {100}, {001}, {011}, {10 $\bar{2}$ }, {10 $\bar{3}$ }, others, perhaps without terminal faces, to 1.5 mm; in sprays, dendritic, botryoidal.

Physical Properties: Hardness = n.d. $D(\text{meas.}) = 6.05$ $D(\text{calc.}) = 6.11$

Optical Properties: Translucent to nearly opaque. *Color:* Dark brown to black; reddish brown in transmitted light. *Streak:* Yellow. *Luster:* Submetallic.

Optical Class: Biaxial (+). *Pleochroism:* X = nearly colorless; Y = dark reddish brown; Z = reddish brown. *Orientation:* $Y = b$; $X \wedge a = 20^\circ$. *Dispersion:* $r > v$, strong. $\alpha = 2.28$
 $\beta = 2.36\text{--}2.38$ $\gamma = 2.48\text{--}2.49$ $2V(\text{meas.}) = \sim 90^\circ$

Cell Data: *Space Group:* $P2_1/m$. $a = 8.810\text{--}8.880$ $b = 6.135\text{--}6.155$ $c = 7.650\text{--}7.681$
 $\beta = 111^\circ 30'\text{--}111^\circ 50'$ $Z = 2$

X-ray Powder Pattern: Venus mine, Argentina.

3.25 (10), 4.95 (8), 2.76 (8), 2.98 (6), 1.720 (6), 3.08 (5), 2.13 (4)

Chemistry:

	(1)		(1)
P_2O_5	0.18	CuO	0.42
V_2O_5	25.32	ZnO	1.29
FeO	4.65	PbO	61.00
MnO	4.77	H_2O	2.03
		Total	99.66

(1) "Sierra de Córdoba," Argentina; corresponds to $\text{Pb}_{1.88}(\text{Mn}_{0.46}^{3+}\text{Fe}_{0.45}^{3+}\text{Zn}_{0.11}\text{Cu}_{0.04})_{\Sigma=1.06}[(\text{V}_{0.96}\text{P}_{0.01})_{\Sigma=0.97}\text{O}_{3.72}]_2(\text{OH})_{1.55}$. (2) Do.; by electron microprobe, average of 10 analyses, not given but stated to correspond to $(\text{Pb}_{1.96}\text{Sr}_{0.01}\text{Ca}_{0.01})_{\Sigma=1.98}(\text{Fe}_{0.77}^{3+}\text{Mn}_{0.13}^{3+}\text{Cu}_{0.03}\text{Zn}_{0.02})_{\Sigma=0.95}(\text{V}_{1.02}\text{O}_4)_2(\text{OH})$. (3) Do.; by electron microprobe, average of 29 analyses, not given but stated to correspond to $(\text{Pb}_{1.89}\text{Sr}_{0.02}\text{Ca}_{0.03}\text{Ba}_{0.01})_{\Sigma=1.95}(\text{Mn}_{0.96}^{3+}\text{Fe}_{0.04}^{3+}\text{Cu}_{0.03}\text{Zn}_{0.01})_{\Sigma=1.04}[(\text{V}_{1.00}\text{As}_{0.01})_{\Sigma=1.01}\text{O}_4]_2(\text{OH})$.

Mineral Group: Brackebuschite group.

Occurrence: A rare secondary mineral in the oxidized zone of hydrothermal Pb–Zn deposits.

Association: Descloizite, vanadinite, wulfenite, cerussite.

Distribution: Found in the Venus, Agua del Rubio, Bienvenida, Pilar, and Algarrobites mines, El Guaico district, Córdoba Province, Argentina. In the USA, from a prospect in the Swisshelm district, Swisshelm Mountains, Cochise Co., and at the Palmetto mine, Santa Cruz Co., Arizona; on the Hack claim, Paradox Valley, Montrose Co., Colorado. From the Kusu vanadium deposit, 85 km southwest of Kinshasa, Bas-Congo Province, Congo (Bas-Zaïre Province, Zaïre). In the Mounana uranium mine, Franceville, Gabon.

Name: Honoring Ludwig Brackebusch (1849–1906), Professor of Mineralogy, University of Córdoba, Córdoba, Argentina.

Type Material: The Natural History Museum, London, England, 55819; Harvard University, Cambridge, Massachusetts, USA, 96255.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 1052–1053. (2) Berry, L.G. and A.R. Graham (1948) X-ray measurements on brackebuschite and hematolite. *Amer. Mineral.*, 33, 489–495. (3) Donaldson, D.M. and W.H. Barnes (1955) The structures of the minerals of the descloizite and adelite groups: III – brackebuschite. *Amer. Mineral.*, 40, 597–613. (4) Fanfani, L. and P.F. Zanazzi (1967) Structural similarities of some secondary lead minerals. *Mineral. Mag.*, 36, 522–529. (5) Symes, R.F. and S.A. Williams (1973) Heyite and brackebuschite compared. *Mineral. Mag.*, 39, 69–73. (6) Foley, J.A., J.M. Hughes, and D. Lange (1997) The atomic arrangement of brackebuschite, redefined as $\text{Pb}_2(\text{Mn}^{3+}, \text{Fe}^{3+})(\text{VO}_4)_2(\text{OH})$, and comments on Mn^{3+} octahedra. *Can. Mineral.*, 35, 1027–1033.

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