Gamagarite $Ba_2(Fe^{3+},Mn^{3+})(VO_4)_2(OH)$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Needlelike crystals, elongated along [010], to more than 1 cm, and as prisms, flattened on [001]; as anhedral grains.

Physical Properties: *Cleavage:* {001} and {100}, distinct; $\{\bar{1}01\}$ difficult, indices probable. Hardness = 4.5–5 D(meas.) = 4.62–4.68 D(calc.) = [4.72] Moderately magnetic.

Optical Properties: Transparent in thin fragments. *Color:* Dark brown to almost black. *Streak:* Reddish brown. *Luster:* Adamantine.
Optical Class: Biaxial (+). *Pleochroism:* X = red-brown; Y = very deep red-brown; Z = light salmon-buff. *Orientation:* $Y = b$; $X \wedge c = 39°–43°$. *Dispersion:* $r < v$, fairly strong. *Absorption:* Y > X > Z. $\alpha = 2.016(10)$ $\beta = 2.040(10)$ $\gamma = 2.130(10)$ 2V(meas.) = 46°–62°

Cell Data: *Space Group:* $P2_1/m$. $a = 9.121–9.15$ $b = 6.142–6.17$ $c = 7.838–7.88$ $\beta = 112.7°–112.88°$ Z = 2

X-ray Powder Pattern: Gloucester Farm, South Africa.
3.309 (100), 3.051 (80), 2.805 (80), 2.349 (50), 4.969 (10), 4.627 (10), 3.711 (10)

Chemistry:

	(1)	(2)	(3)
As_2O_5			3.47
V_2O_5	31.9	31.9	29.07
Al_2O_3	0.0	0.8	
Fe_2O_3	8.4	8.1	7.80
Mn_2O_3		5.7	6.11
MnO	5.5		
SrO			3.60
BaO	52.4	53.5	48.37
H_2O^+	1.06	[1.91]	[1.58]
Total	99.3	[101.9]	[100.00]

(1) Gloucester Farm, South Africa; recalculated from original analysis. (2) Do.; by electron microprobe, total Fe as Fe_2O_3, total Mn as Mn_2O_3, H_2O calculated for charge balance; corresponds to $Ba_{1.99}(Fe^{3+}_{0.58}Mn^{3+}_{0.41}Al_{0.09})_{\Sigma=1.08}(VO_4)_2(OH)_{1.22}$. (3) Molinello mine, Italy; by electron microprobe, total Fe as Fe_2O_3, total Mn as Mn_2O_3, H_2O calculated from crystal-structure analysis; corresponding to $(Ba_{1.80}Sr_{0.20})_{\Sigma=2.00}(Fe^{3+}_{0.56}Mn^{3+}_{0.44})_{\Sigma=1.00}[(VO_4)_{1.83}(AsO_4)_{0.17}]_{\Sigma=2.00}(OH)_{1.00}$.

Mineral Group: Brackebuschite group.

Occurrence: Very rare, in banded manganese ore replacing shale (Gloucester Farm, South Africa); in veinlets cutting manganese ore (Molinello mine, Italy).

Association: Bixbyite, hematite, ephesite, diaspore, amesite (Gloucester Farm, South Africa); braunite, saneroite, bementite, caryopilite, calcite, quartz (Molinello mine, Italy).

Distribution: Along Gamagara Ridge, on Gloucester Farm, about 27 km north of Postmasburg, Cape Province, South Africa. In the Molinello manganese mine, near Chiavari, Val Graveglia, Liguria, Italy.

Name: For the original occurrence on Gamagara Ridge, South Africa.

Type Material: The Natural History Museum, London, England, 1958,553; National Museum of Natural History, Washington, D.C., USA, 105142.

References: (1) de Villiers, J.E. (1943) Gamagarite, a new vanadium mineral from the Postmasburg manganese deposits. Amer. Mineral., 28, 329–335. (2) Harlow, G.E., P.J. Dunn, and G.R. Rossman (1984) Gamagarite: a re-examination and comparison with brackebuschite-like minerals. Amer. Mineral., 69, 803–806. (3) Basso, R., A. Palenzona, and L. Zefiro (1987) Gamagarite: new occurrence and crystal structure refinement. Neues Jahrb. Mineral., Monatsh., 295–305.