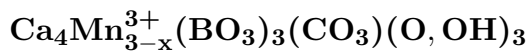


Gaudefroyite



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Crystal Data: Hexagonal. *Point Group:* 6 or 6*m*. Crystals are stubby dipyramidal {11 $\bar{2}$ 0}, or prismatic {01 $\bar{1}$ 0} with prominent pyramidal terminations, to 5 cm; typically as stepwise tapered crystals in divergent aggregates.

Physical Properties: *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = 6 VHN = 840 D(meas.) = 3.35–3.50 D(calc.) = 3.44–3.53

Optical Properties: Opaque, transparent in thin slivers. *Color:* Black; in reflected light, gray with strong yellow-orange to reddish internal reflections. *Luster:* Vitreous to dull.

Optical Class: Uniaxial (+). *Pleochroism:* Strong; *O* = pale yellowish brown; *E* = red-orange. $\omega = 1.81(1)$ $\epsilon = 2.02(1)$ *Anisotropism:* Strong, in pale gray.

R_1 – R_2 : (400) 11.2–15.4, (420) 10.8–14.8, (440) 10.4–14.2, (460) 10.1–13.8, (480) 9.9–13.4, (500) 9.7–13.1, (520) 9.6–12.8, (540) 9.6–12.6, (560) 9.5–12.3, (580) 9.5–12.2, (600) 9.4–12.1, (620) 9.4–12.0, (640) 9.3–11.9, (660) 9.3–11.8, (680) 9.3–11.7, (700) 9.3–11.7

Cell Data: *Space Group:* $P6_3$ or disordered $P6_3/m$. $a = 10.589(1)$ $c = 5.891(1)$ $Z = 2$

X-ray Powder Pattern: Tachgagalt, Morocco.

2.95 (FF), 2.62 (FF), 2.46 (FF), 9.1 (F), 4.54 (F), 2.69 (F), 1.80 (F)

Chemistry:

	(1)	(2)		(1)	(2)
B ₂ O ₃	16.93	17.15	CaO	35.06	36.83
CO ₂	6.57	7.23	BaO		0.07
SiO ₂		0.06	Na ₂ O		0.02
Al ₂ O ₃		0.73	K ₂ O		0.01
Fe ₂ O ₃		0.35	H ₂ O ⁺	0.63	0.61
Mn ₂ O ₃	40.73	37.11	Total	99.92	100.17

(1) Tachgagalt, Morocco; H₂O by the Penfield method, includes pyrolusite estimated at 5.4%; corresponds to $\text{Ca}_{4.00}\text{Mn}_{2.83}(\text{BO}_3)_{3.09}(\text{CO}_3)_{0.95}[\text{O}_{2.78}(\text{OH})_{0.22}]_{\Sigma=3.00}$. (2) Wessels mine, South Africa; by electron microprobe, corresponding to $\text{Ca}_4\text{Mn}_{2.86}(\text{BO}_3)_3(\text{CO}_3)[\text{O}_{2.59}(\text{OH})_{0.41}]_{\Sigma=3.00}$.

Occurrence: An uncommon hydrothermal mineral in manganese deposits.

Association: Marokite, braunite, hausmannite, crednerite, pyrolusite, calcite, quartz, brucite (Tachgagalt, Morocco); barite, calcite, hydrogrossular, manganite, bixbyite, braunite, hausmannite, hematite (Kuruman district, South Africa).

Distribution: From Tachgagalt, 17 km south-southwest of Ouarzazate, Anti-Atlas Mountains, Morocco. At the Wessels and N'Chwaning mines, near Kuruman, Cape Province, South Africa.

Name: Honors Abbé Christophe Gaudefroy (1888–1971), French mineralogist who worked in Morocco.

Type Material: Geological Survey of Morocco, Rabat, Morocco; Natural History Museum, Paris, 165.34; National School of Mines, Paris, France.

References: (1) Jouravsky, G. and F. Permingeat (1964) La gaudefroyite, une nouvelle espèce minérale. Bull. Minéral., 87, 216–229 (in French). (2) (1965) Amer. Mineral., 50, 806–807 (abs. ref. 1). (3) Beukes, G.J., H. de Bruijn, and W.A. van der Westhuizen (1993) Gaudefroyite from the Kalahari manganese field, South Africa. Neues Jahrb. Mineral., Monatsh., 385–392. (4) Hoffmann, C., T. Ambruster, and M. Kunz (1997) Structural refinement of (001) disordered gaudefroyite $\text{Ca}_4\text{Mn}_3^{3+}[(\text{BO}_3)_3(\text{CO}_3)\text{O}_3]$: Jahn-Teller-distortion in edge-sharing chains of Mn^{3+}O_6 octahedra. Eur. J. Mineral., 9, 7–19.

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