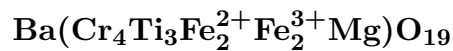


Hawthorneite



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Crystal Data: Hexagonal. *Point Group:* $6/m2/m2/m$. As grains, to 100 μm , surrounded by lindsleyite, oriented in spinel.

Physical Properties: Hardness = ~ 5.8 VHN = 772–835, 801 average (100 g load).
D(meas.) = n.d. D(calc.) = 5.02

Optical Properties: Opaque. *Color:* [Black or brown]; light gray in reflected light.
Optical Class: Uniaxial (-). *Dispersion:* $r < v$. *Anisotropism:* Weak to moderate; in browns and grays. *Birefractance:* Weak to moderate.

R_1 – R_2 : (400) 19.5–18.1, (420) 19.1–17.8, (440) 18.8–17.5, (460) 18.4–17.2, (480) 18.1–17.0, (500) 17.9–16.8, (520) 17.7–16.6, (540) 17.6–16.5, (560) 17.4–16.4, (580) 17.3–16.3, (600) 17.2–16.2, (620) 17.2–16.2, (640) 17.1–16.1, (660) 17.0–16.0, (680) 17.0–16.0, (700) 16.9–15.9

Cell Data: *Space Group:* $P6_3/mmc$. $a = 5.871(2)$ $c = 23.06(2)$ $Z = 2$

X-ray Powder Pattern: Calculated.

2.616 (100), 2.765 (85), 2.414 (49), 1.468 (45), 2.936 (42), 1.617 (42), 1.660 (38)

Chemistry:

	(1)		(1)
Nb ₂ O ₅	0.16	Cr ₂ O ₃	34.05
Ta ₂ O ₅	0.18	FeO	13.83
SiO ₂	0.06	MnO	0.12
TiO ₂	22.94	MgO	3.07
La ₂ O ₃	0.10	BaO	12.52
Ce ₂ O ₃	0.31	Na ₂ O	0.10
Fe ₂ O ₃	11.31	K ₂ O	0.55
		Total	99.30

(1) Bultfontein mine, South Africa; by electron microprobe, average of 11 analyses, $\text{Fe}^{2+}:\text{Fe}^{3+}$ calculated from charge balance; corresponds to $(\text{Ba}_{0.85}\text{K}_{0.12})_{\Sigma=0.97}(\text{Cr}_{4.68}\text{Ti}_{3.02}\text{Fe}_{2.02}^{2+}\text{Fe}_{1.47}^{3+}\text{Mg}_{0.80}\text{Mn}_{0.02}\text{Nb}_{0.01})_{\Sigma=12.02}\text{O}_{19}$.

Mineral Group: Magnetoplumbite group.

Occurrence: Formed during upper-mantle (75–100 km, 900–1100 °C, 20–30 kbar) metasomatism of chromian spinel in peridotite xenoliths in a kimberlite pipe.

Association: Olivine, enstatite, phlogopite, potassian richterite, diopside, magnesian chromian spinel, lindsleyite, mathiasite, niobian chromian rutile, magnesian chromian ilmenite.

Distribution: From the Bultfontein diamond mine, Kimberley, Cape Province, South Africa.

Name: For John Barry Hawthorne (1934–), formerly Chief Geologist (Diamonds), DeBeers Consolidated Mines, South Africa, in honor of his contributions to studies of the upper mantle.

Type Material: The Natural History Museum, London, England, 1988,71.

References: (1) Haggerty, S.E., I.E. Grey, I.C. Madsen, A.J. Criddle, C.J. Stanley, and A.J. Erlank (1989) Hawthorneite, $\text{Ba}[\text{Ti}_3\text{Cr}_4\text{Fe}_4\text{Mg}]\text{O}_{19}$: a new metasomatic magnetoplumbite-type mineral from the upper mantle. *Amer. Mineral.*, 74, 668–673. (2) Grey, I.E., I.C. Madsen, and S.E. Haggerty (1987) Structure of a new upper-mantle, magnetoplumbite-type phase, $\text{Ba}[\text{Ti}_3\text{Cr}_4\text{Fe}_4\text{Mg}]\text{O}_{19}$. *Amer. Mineral.*, 72, 633–636.