

# Hibonite

# (Ca, Ce, La)(Al, Ti, Mg)<sub>12</sub>O<sub>19</sub>

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**Crystal Data:** Hexagonal. *Point Group:* 6/m2/m2/m. Prisms, platy on {0001}, or steep pyramidal, to 4 cm, showing six sectors on {0001}.

**Physical Properties:** *Cleavage:* {0001}, good; parting on {10 $\bar{1}$ 0}. *Fracture:* Subconchoidal. Hardness = 7.5–8 D(meas.) = 3.84(1) D(calc.) = [4.09] Slightly radioactive.

**Optical Properties:** Semitransparent. *Color:* Brownish black to black; reddish brown in thin fragments; blue in meteorites. *Streak:* Brown. *Luster:* Vitreous.

*Optical Class:* Uniaxial (-). *Pleochroism:* O = brownish gray; E = gray.  $\omega = 1.807(2)$   
 $\epsilon = 1.79(1)$

**Cell Data:** *Space Group:* P6<sub>3</sub>/mmc.  $a = 5.57\text{--}5.61$   $c = 22.01\text{--}22.20$   $Z = 2$

**X-ray Powder Pattern:** Mahenge, Tanzania.

2.505 (10), 2.648 (8), 2.812 (6), 2.131 (6), 2.030 (5), 1.404 (5), 2.311 (4)

Chemistry:	(1)	(2)	(1)	(2)
SiO <sub>2</sub>	1.50	0.75	Nd <sub>2</sub> O <sub>3</sub>	0.2
TiO <sub>2</sub>	8.50	5.6	Fe <sub>2</sub> O <sub>3</sub>	0.45
Al <sub>2</sub> O <sub>3</sub>	74.00	72.8	FeO	2.30
La <sub>2</sub> O <sub>3</sub>		1.8	MgO	3.20
Ce <sub>2</sub> O <sub>3</sub>	3.50	2.1	CaO	6.50
			<hr/>	
			Total	99.95 99.72

(1) Esiva, Madagascar; all RE taken as Ce, corresponds to (Ca<sub>0.80</sub>RE<sub>0.15</sub>) $_{\Sigma=0.95}$ (Al<sub>10.16</sub>Ti<sub>0.74</sub>Mg<sub>0.56</sub>Fe<sub>0.22</sub><sup>2+</sup>Si<sub>0.18</sub>Fe<sub>0.04</sub><sup>3+</sup>) $_{\Sigma=11.90}$ O<sub>18.95</sub>. (2) Mahenge, Tanzania; by electron microprobe, average of 14 analyses, Fe<sup>2+</sup>:Fe<sup>3+</sup> calculated from stoichiometry; corresponds to (Ca<sub>0.80</sub>Ce<sub>0.09</sub>La<sub>0.08</sub>Nd<sub>0.01</sub>) $_{\Sigma=0.98}$ (Al<sub>10.38</sub>Fe<sub>0.74</sub><sup>2+</sup>Ti<sub>0.51</sub>Fe<sub>0.25</sub><sup>3+</sup>Si<sub>0.09</sub>Mg<sub>0.05</sub>) $_{\Sigma=12.02}$ O<sub>19</sub>.

**Mineral Group:** Magnetoplumbite group.

**Occurrence:** In metamorphosed limestone, pyroxenite, gneiss, and granulite of the amphibolite to granulite facies; also alluvial. A common accessory in Ca–Al-rich inclusions in some carbonaceous chondrites.

**Association:** Calcic plagioclase, corundum, spinel, thorianite, titanite (Esiva, Madagascar); anorthite, grossular, titanite, zoisite, clinozoisite (Mahenge, Tanzania); vesuvianite, hercynite, corundum, andalusite, kyanite, diopside, rutile, titanite, magnetite (Shoriya Mountains, Russia).

**Distribution:** From Esiva, near Taolaiñaro (Fort Dauphin), and near Ambindandrakemba, Madagascar. In Tanzania, in the Furura granulite complex, southwest of Mahenge. In the Shoriya Mountains, about 400 km southeast of Novosibirsk, western Siberia, and several other less-well-defined places in Russia. From Punalur, Kerala, India. Noted in some carbonaceous chondrite meteorites, as Allende, Murchison, etc.

**Name:** For Paul Hibon, who discovered the mineral.

**Type Material:** National School of Mines, Paris, France; Harvard University, Cambridge, Massachusetts, USA, 106213.

**References:** (1) Curien, H., C. Guillemin, J. Orcel, and M. Sternberg (1956) La hibonite, nouvelle espèce minérale. *Compt. Rendus Acad. Sci. Paris*, 242, 2845–2847 (in French). (2) (1957) *Amer. Mineral.*, 42, 119 (abs. ref. 1). (3) Maaskant, P., J.J.M.M.M. Coolen, and E.A.J. Burke (1980) Hibonite and coexisting zoisite and clinozoisite in a calc-silicate granulite from southern Tanzania. *Mineral. Mag.*, 43, 995–1003. (4) Kato, K. and H. Saalfeld (1968) Verfeinerung der Kristallstruktur von CaO•6Al<sub>2</sub>O<sub>3</sub>. *Neues Jahrb. Mineral., Abh.*, 109, 192–200 (in German with English abs.).

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