

**Crystal Data:** Cubic. *Point Group:*  $4/m\bar{3}2/m$ . Crystals octahedral, to 5 mm; more commonly granular, massive. *Twinning:* On {111} as both twin and composition plane, the spinel law, as contact twins.

**Physical Properties:** *Cleavage:* {111} parting likely. *Tenacity:* Brittle. Hardness = 6–6.5 VHN = 899–910 (100 g load). D(meas.) = 4.55–4.65 D(calc.) = 4.556 Strongly magnetic.

**Optical Properties:** Opaque, transparent in thin fragments. *Color:* Black to brownish black; reddish brown in transmitted light; gray in reflected light with red internal reflections.

*Streak:* Black. *Luster:* Metallic to semimetallic, may be dull.

*Optical Class:* Isotropic.  $n = 2.38$

R: (470) 18.9, (546) 18.5, (589) 18.3, (650) 17.5

**Cell Data:** *Space Group:*  $Fd\bar{3}m$ .  $a = 8.37$ – $8.39$   $Z = 8$

**X-ray Powder Pattern:** Synthetic. (ICDD 17-464).

2.525 (100), 2.96 (40), 1.481 (35), 1.612 (30), 2.094 (25), 1.709 (14), 1.090 (12)

Chemistry:	(1)	(2)	(3)	(1)	(2)	(3)
TiO <sub>2</sub>		23.4		FeO	1.79	27.9
Al <sub>2</sub> O <sub>3</sub>		7.14		MnO	4.61	0.38
Fe <sub>2</sub> O <sub>3</sub>	74.73	24.0	79.85	MgO	18.22	16.9
Cr <sub>2</sub> O <sub>3</sub>		1.24				20.15
				<b>Total</b>	<b>99.35</b>	<b>100.96</b>
						<b>100.00</b>

(1) Långban, Sweden. (2) Benfontein sill, South Africa; by electron microprobe, Fe<sup>2+</sup>:Fe<sup>3+</sup> calculated from stoichiometry; corresponds to (Mg<sub>0.80</sub>Fe<sub>0.19</sub><sup>2+</sup>Mn<sub>0.01</sub>)<sub>Σ=1.00</sub>(Fe<sub>0.58</sub><sup>3+</sup>Ti<sub>0.56</sub>Fe<sub>0.56</sub><sup>2+</sup>Al<sub>0.27</sub>Cr<sub>0.03</sub>)<sub>Σ=2.00</sub>O<sub>4</sub>. (3) MgFe<sub>2</sub>O<sub>4</sub>.

**Polymorphism & Series:** Forms a series with magnetite.

**Mineral Group:** Spinel group.

**Occurrence:** Most commonly of fumarolic origin; also in high-grade (sanidinite facies) combustion-metamorphosed marls and burning coal heaps; in metamorphosed dolostones. An accessory mineral in some kimberlites, carbonatites, and alkali gabbros. As skeletal inclusions in glassy spherules in sediments attributed to bolide impact debris.

**Association:** Hematite, titanian magnetite, ferrian diopside.

**Distribution:** Numerous localities. In Italy, on Vesuvius and Monte Somma, Campania; on Etna, Sicily; from Stromboli and Vulcano, Lipari Islands. On Puy de la Tache, Mont Dore, Puy-de-Dôme, France. In the Hatrurim Formation, Israel. At Husereau Hill, Oka complex, Quebec, Canada. In the USA, from the Crestmore quarry, Riverside Co., California and at Magnet Cove, Hot Spring Co., Arkansas. Abundant at Långban, Värmland, Sweden. In Russia, from mines around Kopeysk, Chelyabinsk coal basin, Southern Ural Mountains; in the Tazheran alkalic massif, west of Lake Baikal, Siberia; and in the Konder alkalic massif, Aldan Shield, Sakha. As a minor constituent of the widespread sediments marking some major geological period boundaries, as the Cretaceous-Tertiary.

**Name:** From the composition, with dominant MAGNESium and FERRic iron.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 698–707. (2) van de Pijpekamp, B., E.A.J. Burke, and P. Maaskant (1974) Magnesioferrite, a mineral new for Långban, Sweden. *Arkiv Min. Geol.*, 5(1), 1–10. (3) O'Neill, H.St.C., H. Annersten, and D. Virgo (1992) The temperature dependence of the cation distribution in magnesioferrite (MgFe<sub>2</sub>O<sub>4</sub>) from powder XRD structural refinements and Mössbauer spectroscopy. *Amer. Mineral.*, 77, 725–740.

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