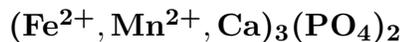


Graftonite

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Crystal Data: Monoclinic. *Point Group:* $2/m$. Very rare crude crystals, stout prismatic; usually massive, cleavable, in laminated intergrowths with triphylite, to 0.5 m.

Physical Properties: *Cleavage:* On {010}, good; on {100}, fair. *Fracture:* Uneven to subconchoidal. Hardness = 5 D(meas.) = 3.67–3.79 D(calc.) = [3.71]

Optical Properties: Semitransparent. *Color:* Salmon-pink to reddish brown, dark brown when altered; in transmitted light, nearly colorless. *Streak:* White to pale pink. *Luster:* Vitreous towards resinous.

Optical Class: Biaxial (+). *Pleochroism:* Faint; $X = Y =$ colorless; $Z =$ pink. *Orientation:* $X = b$; $Z \wedge c = -36^\circ$. *Dispersion:* $r > v$ or $r < v$, strong. $\alpha = 1.695\text{--}1.709$ $\beta = 1.699\text{--}1.714$ $\gamma = 1.719\text{--}1.736$ $2V(\text{meas.}) = 50^\circ\text{--}60^\circ$

Cell Data: *Space Group:* $P2_1/c$. $a = 8.87\text{--}8.91$ $b = 11.57\text{--}11.58$ $c = 6.17\text{--}6.24$
 $\beta = 98^\circ 54'\text{--}99^\circ 12'$ $Z = 4$

X-ray Powder Pattern: Greenwood, Maine, USA.
2.867 (10), 3.50 (9), 2.715 (7), 3.01 (4), 4.30 (3), 2.953 (3), 2.410 (2)

Chemistry:	(1)	(2)		(1)	(2)
P ₂ O ₅	41.20	39.66	Na ₂ O		0.28
Al ₂ O ₃		0.20	(Li, Na) ₂ O	0.33	
Fe ₂ O ₃		0.00	K ₂ O		0.00
FeO	30.65	30.70	F		0.20
MnO	17.62	21.81	H ₂ O	0.75	0.60
MgO	0.40	0.10	–O = F ₂		0.08
CaO	9.23	6.00	insol.		0.16
Li ₂ O		0.05	Total	100.18	99.68

(1) Grafton, New Hampshire, USA. (2) Nickel Plate mine, South Dakota, USA; corresponds to $(\text{Fe}_{1.52}^{2+}\text{Mn}_{1.09}^{2+}\text{Ca}_{0.38}\text{Na}_{0.03}\text{Al}_{0.02}\text{Mg}_{0.01}\text{Li}_{0.01})_{\Sigma=3.06}(\text{PO}_4)_{1.98}$.

Polymorphism & Series: Forms a series with beusite.

Occurrence: A primary mineral or exsolution product in complex granite pegmatites.

Association: Triphylite, lithiophilite, sarcopside, ferrisicklerite, heterosite, arrojadite, fairfieldite, barbosalite, huréaulite, almandine, zircon, albite, muscovite, biotite.

Distribution: In the USA, on Melvin Mountain, about eight km west of Grafton, at the Palermo #1 and Rice mines, near North Groton, Grafton Co., at the Parker Mountain quarry, Center Strafford, Strafford Co., and many other places in New Hampshire; from the Waisenen quarry, Greenwood, Oxford Co., Maine; in the Bull Moose mine, five km southeast of Custer, Custer Co., and at the Nickel Plate mine, 1.5 km south of Keystone, Pennington Co., South Dakota. From near São Luiz do Paraitinga, São Paulo, and the Énio pegmatite mine, northeast of Galiléia, Minas Gerais, Brazil. At the Ranquel and Cacique Canchuleta mines, San Luis, Argentina. From Sidi Bou Othmane, Morocco. In the Valle della Madonna, Brissago, Tessin, Switzerland. At Olgiasca, Lake Como, Lombardy, Italy. From Hagendorf, Bavaria, Germany. In the Kondakov district, eastern Siberia, Russia. Additional localities continue to be recognized.

Name: For its first-noted occurrence near Grafton, New Hampshire, USA.

Type Material: Yale University, New Haven, Connecticut, 3.2345; National Museum of Natural History, Washington, D.C., USA, C4037, R5183.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 686–688. (2) Lindberg, M.L. (1950) Arrojadite, hühnerkobelite, and graftonite. *Amer. Mineral.*, 35, 59–76. (3) Calvo, C. (1968) The crystal structure of graftonite. *Amer. Mineral.*, 53, 742–750. (4) Nord, A.G. and T. Ericsson (1982) The cation distribution in synthetic $(\text{Fe}, \text{Mn})_3(\text{PO}_4)_2$ graftonite-type solid solutions. *Amer. Mineral.*, 67, 826–832.

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