

Crystal Data: Hexagonal or monoclinic. *Point Group:* $6/m$ or $2/m$. As prismatic hexagonal crystals, elongated on [0001], dominated by $\{10\bar{1}0\}$ and $\{10\bar{1}1\}$, to 2 m; as complex tabular to discoidal crystals flattened on $\{0001\}$, typically with many forms; granular, globular to reniform, nodular, massive. *Twinning:* Rare as contact twins on $\{11\bar{2}1\}$ or $\{10\bar{1}3\}$.

Physical Properties: *Cleavage:* Poor on $\{0001\}$ and $\{10\bar{1}0\}$. *Fracture:* Conchoidal to uneven. *Tenacity:* Brittle. Hardness = 5 D(meas.) = 3.1–3.25 D(calc.) = 3.18 May be cathodoluminescent, phosphorescent, or fluorescent in UV.

Optical Properties: Transparent to translucent. *Color:* Sea-green, violet, purple, blue, pink, yellow, brown, white, colorless, may be zoned; colorless or faintly tinted in thin section. *Streak:* White. *Luster:* Vitreous to subresinous. *Optical Class:* Uniaxial (-). *Pleochroism:* Weak to strong if colored. *Absorption:* $E > O$. $\omega = 1.631\text{--}1.650$ $\epsilon = 1.627\text{--}1.646$

Cell Data: *Space Group:* $P6_3/m$. $a = 9.3973$ $c = 6.8782$ $Z = 2$, or *Space Group:* $P2_1/b$. $a = 9.4877$ $b = 18.9628$ $c = 6.8224$ $\beta = 119.97^\circ$ $Z = 6$

X-ray Powder Pattern: Synthetic.

2.800 (100), 2.702 (60), 2.772 (55), 3.442 (40), 2.624 (30), 1.837 (30), 1.937 (25)

| Chemistry: | (1) | (2) | (1) | (2) | (1) | (2) |
|--------------------------------|-------|-------|-------|--------|--------|--------------------------|
| P ₂ O ₅ | 42.01 | 42.22 | CaO | 55.52 | 55.60 | -O = F ₂ 1.63 |
| RE ₂ O ₃ | 0.28 | | F | 3.89 | 3.67 | 1.59 |
| | | | Total | 100.07 | 100.00 | |

(1) Gloserheia pegmatite, Froland, Norway; RE₂O₃ = Y₂O₃ 0.10%, Nd₂O₃ 0.06%, Gd₂O₃ 0.06%, Yb₂O₃ 0.06%; corresponds to Ca_{5.00}(PO₄)_{2.99}F_{1.03}. (2) Ca₅(PO₄)₃F.

Mineral Group: Apatite group; F > Cl or OH.

Occurrence: The most common rock-forming phosphate mineral. Accessory in most igneous rocks, important in syenites, alkaline rocks, carbonatites, granite pegmatites. Common in marbles and skarns, Ca-rich regional metamorphic rocks, Alpine-type fissures, and hydrothermal tin veins. An essential component of sedimentary phosphorites, common as a detrital or diagenetic component in oolitic ironstones and phosphatic carbonate rocks and shales. Residual in laterites.

Association: Diopside, forsterite, scapolite, phlogopite, chondrodite, calcite, magnetite.

Distribution: A few of the many localities for fine crystals include: at Ehrenfriedersdorf, Saxony, Germany. From Untersulzbachtal, Salzburg, Austria. At Panasqueira, Portugal. From near Pech, Kunar Province, Afghanistan. At Chumar Bakhoo, Nagar, Gilgit district, Pakistan. In Brazil, at the Morro Velho gold mine, Nova Lima, Minas Gerais. From Llallagua, Potosí, Bolivia. At Cerro de Mercado, Durango, Mexico. From the Pulsifer quarry, Mt. Apatite, Auburn, Androscoggin Co., Maine, USA. In Canada, large crystals from southeastern Ontario, as in Renfrew Co., and in adjoining southwestern Quebec, as in Ottawa Co., etc. An important ore in carbonatites; in Russia, in the Khibiny and Kovdor massifs, Kola Peninsula; from the Slyudyanka region, Lake Baikal, eastern Siberia. At Phalaborwa, Transvaal, South Africa. From the Jacupiranga mine, São Paulo, and at Tapira, Minas Gerais, Brazil. In the Mt. Weld carbonatite, 35 km south of Laverton, Western Australia.

Name: For dominant *fluorine* and membership in the *apatite* group, the group name from the Greek for *to deceive*, for the ease with which specimens were confused with other minerals.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 879–889. (2) Chang, L.L.Y., R.A. Howie, and J. Zussman (1996) Rock-forming minerals, (2nd edition), v. 5B, non-silicates, 297–334. (3) Phillips, W.R. and D.T. Griffen (1981) Optical mineralogy, 81–84. (4) Hughes, J.M., M. Cameron, and K.D. Crowley (1989) Structural variation in natural F, OH, and Cl apatites. Amer. Mineral., 74, 870–876. (5) Hughes, J.M., M. Cameron, and K.D. Crowley (1990) Crystal structures of natural ternary apatites: solid solution in the Ca₅(PO₄)₃X (X = F, OH, Cl) system. Amer. Mineral., 75, 295–304. (6) (1964) NBS Mono. 25(3), 22.

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