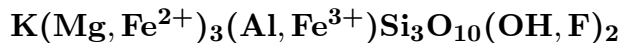


Biotite

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Crystal Data: Monoclinic. *Point Group:* $2/m$. Uncommon in good crystals, tabular or short prismatic, with pseudo-hexagonal outline, to 3 m. Typically irregular foliated or bent masses; in scaly aggregates or disseminated grains. *Twinning:* On composition plane {001}, twin axis [310].

Physical Properties: *Cleavage:* {001}, perfect. *Tenacity:* Brittle to flexible, elastic. Hardness = 2.5–3 D(meas.) = 2.7–3.3 D(calc.) = 3.25

Optical Properties: Semitransparent. *Color:* Dark green, brown, black, reddish brown, light yellow, grayish yellow, brownish green, brown; yellow to reddish brown in thin section. *Streak:* White. *Luster:* Splendent to submetallic, vitreous, pearly on cleavage. *Optical Class:* Biaxial (-). *Pleochroism:* Strong; X = gray-yellow, yellow-brown, orange-brown; Y = Z = dark brown, dark green, dark red-brown. *Orientation:* Y = b; X \wedge c = 0°–3°; Z \wedge a = 0°–9°. *Dispersion:* r < v, Fe-rich; may be r > v, Mg-rich; weak. *Absorption:* Y \simeq Z \gg X. $\alpha = 1.565\text{--}1.625$ $\beta = 1.605\text{--}1.696$ $\gamma = 1.605\text{--}1.696$ 2V(meas.) = 0°–25°

Cell Data: *Space Group:* $C2/m$. a = 5.3 b = 9.2 c = 10.2 $\beta = 100^\circ$ Z = 2

X-ray Powder Pattern: Edenville, Orange Co., New York, USA.

10.1 (100), 3.37 (100), 2.66 (80), 2.45 (80), 2.18 (80), 2.00 (80), 1.67 (80)

Chemistry:	(1)	(1)	(1)
SiO ₂	36.25	MnO	0.49
TiO ₂	3.39	MgO	11.80
Al ₂ O ₃	13.90	CaO	0.00
Fe ₂ O ₃	6.80	Li ₂ O	0.03
FeO	14.81	Na ₂ O	0.10
		K ₂ O	9.57
		Cl	0.06
		H ₂ O ⁺	2.80
		Total	100.00

(1) Vercelli, Italy; by electron microprobe, average of six analyses on one grain, Fe³⁺ by a semimicrovolumetric method, H₂O by TGA; corresponds to (K_{0.94}Na_{0.02}) $\Sigma=0.96$ (Mg_{1.35}Fe_{0.95}Mn_{0.03}) $\Sigma=2.33$ (Fe_{0.39}Ti_{0.20}Al_{0.05}Li_{0.01}) $\Sigma=0.65$ (Si_{2.79}Al_{1.21}) $\Sigma=4.00$ [O_{10.55}(OH)_{1.44}Cl_{0.01}] $\Sigma=12.00$, in the general structural formula K(Mg, Fe²⁺)₃₋₂(Al, Fe³⁺, Ti)₀₋₁(Si_{3-2.5}Al_{1--1.5}) $\Sigma=4$ O₁₀₋₋₁₁(OH, F)₂₋₋₁.

Polymorphism & Series: 1M, 2M₁, 3A polytypes.

Mineral Group: Mica group.

Occurrence: An important rock-forming mineral under a wide range of conditions. In regionally metamorphosed schists and gneisses, and in contact metamorphosed rocks; in granites to nepheline syenites; less common in extrusive igneous rocks, from rhyolites to basalts. Characteristic of potassic hydrothermal alteration; in detrital sediments.

Association: Quartz, potassic feldspar, plagioclase, nepheline, muscovite, pyroxenes, amphiboles, andalusite, cordierite, garnet, spinel.

Distribution: Good crystals from: in Italy, at Vesuvius and Monte Somma, Campania, and in the Pfitschtal and on Mt. Monzoni, Val di Fassa, Trentino-Alto Adige. At Brevik and Arendal, Norway. From near Miass, Ilmen Mountains, Southern Ural Mountains, Russia. In the USA, from Franklin and Sterling Hill, Ogdensburg, Sussex Co., New Jersey; Monroe, Orange Co., and Russell, St. Lawrence Co., New York; at Easton, Northampton Co., Pennsylvania; from the Pala and Rincon districts, San Diego Co., California. In Canada, in Ontario, at Bancroft, Wakefield, and Otter Lake, Parry Sound; in Quebec, in the Bear Lake mine, Pontiac Co.

Name: For the French mineralogist and physicist, Jean Baptiste Biot (1774–1862).

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 627–632. (2) Deer, W.A., R.A. Howie, and J. Zussman (1963) Rock-forming minerals, v. 3, sheet silicates, 55–84. (3) Nagelschmidt, G. (1937) X-ray investigations on clays. Part III. Zeits. Krist., 97, 514–521. (4) Brigatti, M.F. and P. Davoli (1990) Crystal-structure refinements of 1M plutonic biotites. Amer. Mineral., 75, 305–313.

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