

Rhönite**Ca₂(Mg, Fe²⁺, Fe³⁺, Ti)₆(Si, Al)₆O₂₀**

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Crystal Data: Triclinic, pseudomonoclinic. *Point Group:* $\bar{1}$. As prismatic or tabular crystals, to several cm; as skeletal grains with well-developed crystal faces; anhedral grains and aggregates. *Twinning:* Polysynthetic $\parallel \{010\}$, common.

Physical Properties: *Cleavage:* $\{010\}$, $\{001\}$, good. Hardness = 5–6 D(meas.) = 3.4–3.76 D(calc.) = [3.64]

Optical Properties: Translucent to opaque. *Color:* Dark brown to black. *Luster:* Semimetallic.

Optical Class: Biaxial (+). *Pleochroism:* Strong; X = dark greenish brown, red-brown; Y = dark reddish to greenish brown; Z = dark reddish brown to black. *Dispersion:* $r < v$, extreme. *Absorption:* $Z > Y > X$. $\alpha = 1.795\text{--}1.810$ $\beta = 1.806\text{--}1.825$ $\gamma = 1.830\text{--}1.845$ $2V(\text{meas.}) = 50^\circ$ to $\sim 90^\circ$ $2V(\text{calc.}) = 65^\circ$

Cell Data: *Space Group:* $P\bar{1}$. $a = 10.37\text{--}10.43$ $b = 10.76\text{--}11.21$ $c = 8.92\text{--}9.02$
 $\alpha = 102^\circ\text{--}106^\circ$ $\beta = 96^\circ\text{--}101^\circ$ $\gamma = 124^\circ\text{--}127^\circ$ $Z = 2$

X-ray Powder Pattern: Study Butte, Texas, USA.

2.947 (100), 2.550 (69), 2.691 (65), 2.092 (56), 1.498 (38), 2.783 (31), 1.991 (25)

Chemistry:	(1)	(2)	(1)	(2)	(1)	(2)		
SiO ₂	24.42	30.74	FeO	11.39	[0.37]	Na ₂ O	0.67	3.08
TiO ₂	9.46	5.73	MnO	trace	0.26	K ₂ O	0.63	0.06
Al ₂ O ₃	17.25	12.66	MgO	12.62	19.50	Total	100.56	[98.11]
Fe ₂ O ₃	11.69	[17.37]	CaO	12.43	8.36			

(1) Scharnhäusen, Germany; corresponds to $(\text{Ca}_{1.78}\text{Na}_{0.18}\text{K}_{0.11})_{\Sigma=2.07}(\text{Mg}_{2.52}\text{Fe}_{1.28}^{\text{2+}}\text{Fe}_{1.17}^{\text{3+}}\text{Ti}_{0.96})_{\Sigma=5.93}(\text{Si}_{3.27}\text{Al}_{2.72}\text{Fe}_{0.01}^{\text{3+}})_{\Sigma=6.00}\text{O}_{20}$. (2) Kalaheo, Hawaii, USA; by electron microprobe, $\text{Fe}^{2+}:\text{Fe}^{3+}$ calculated from stoichiometry, original total given as 98.12%; corresponds to $(\text{Ca}_{1.16}\text{Na}_{0.77}\text{K}_{0.01})_{\Sigma=1.94}(\text{Mg}_{3.78}\text{Fe}_{1.65}^{\text{3+}}\text{Ti}_{0.56}\text{Fe}_{0.04}^{\text{2+}}\text{Mn}_{0.03})_{\Sigma=6.06}(\text{Si}_{4.01}\text{Al}_{1.94}\text{Fe}_{0.05}^{\text{3+}})_{\Sigma=6.00}\text{O}_{20}$.

Mineral Group: Aenigmatite group.

Occurrence: In silica-undersaturated, alkalic, mafic to intermediate igneous rocks, as a primary mineral or an alteration product of amphiboles. Also developed at the contact of alkalic basalt and limestone.

Association: Titanian augite, kaersutite, alkalic feldspar, diopside, forsterite, spinel, perovskite, titanian magnetite, magnesioferrite.

Distribution: In Germany, in the Rhön Mountains, at Scharnhäusen, near Stuttgart, Hesse; from Eichersattel, Sattelberg, and other volcanic cones in the Eifel district; at the Löbauer Berg, Saxony, and other places. From Skåne, Sweden. In France, from Puy de Saint-Sandoux, Auvergne; south of Bort-les-Orgues, Puy-de-Dôme; and at Monistrol-d'Allier, Haute Loire. From Hobbs Land, Greenland, at Dunedin volcano, Otago Harbour, South Island. On Hut Point Peninsula, Ross Island, Antarctica. At Dogo, Oki Islands, Japan. Found near Study Butte, Brewster Co., Texas, and north of Kalaheo, Kauai, Hawaii, USA.

Name: For the Rhön district, Germany, from where it was first identified.

Type Material: n.d.

References: (1) Dana, E.S. and W.E. Ford (1909) Dana's system of mineralogy, (6th edition), app. II, 88–89. (2) Deer, W.A., R.A. Howie, and J. Zussman (1978) Rock-forming minerals, (2nd edition), v. 2A, single-chain silicates, 655–658. (3) Cameron, K.L., M.F. Carman, and J.C. Butler (1970) Rhönite from Big Bend National Park, Texas. Amer. Mineral., 55, 864–874. (4) Johnston, A.D. and J.H. Stout (1985) Compositional variation of naturally occurring rhoenite [rhönite]. Amer. Mineral., 70, 1211–1216. (5) Bonaccorsi, E., S. Merlino, and M. Pasero (1990) Rhönite: structural and microstructural features, crystal chemistry and polysomatic relationships. Eur. J. Mineral., 2, 203–218.

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