

Ferroaxinite**Ca₂Fe²⁺Al₂BSi₄O₁₅(OH)**

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Crystal Data: Triclinic. *Point Group:* $\bar{1}$. Crystals typically flattened, axe-head-shaped, to 20 cm; granular, massive.

Physical Properties: *Cleavage:* Good on {100}, poor on {001}, {110}, and {011}.
Fracture: Uneven to conchoidal. *Tenacity:* Brittle. Hardness = 6.5–7 D(meas.) = 3.25–3.28
 D(calc.) = [3.33]

Optical Properties: Transparent to translucent. *Color:* Clove-brown, brown, plum-blue, pearl-gray; colorless to pale brown or blue in thin section. *Luster:* Vitreous.
Optical Class: Biaxial (-). $\alpha = 1.674\text{--}1.682$ $\beta = 1.682\text{--}1.690$ $\gamma = 1.685\text{--}1.693$
 $2V(\text{meas.}) = 65^\circ\text{--}75^\circ$

Cell Data: *Space Group:* $P\bar{1}$. $a = 7.1437(4)$ $b = 9.1898(6)$ $c = 8.9529(4)$
 $\alpha = 91.857(6)^\circ$ $\beta = 98.188(5)^\circ$ $\gamma = 77.359(4)^\circ$ $Z = 2$

X-ray Powder Pattern: Isère, France.
 2.812 (100), 3.16 (90), 3.46 (80), 6.30 (70), 3.68 (60), 3.28 (60), 2.998 (60)

| Chemistry: | (1) | (2) | (3) | | (1) | (2) | (3) |
|--------------------------------|-------|--------|-------|-------------------------------|--------------|----------------|---------------|
| SiO ₂ | 43.14 | 41.97 | 42.16 | ZnO | 0.04 | | |
| TiO ₂ | 0.10 | | | MgO | 1.34 | 0.66 | |
| B ₂ O ₃ | 6.12 | [6.14] | 6.11 | CaO | 19.76 | 19.18 | 19.67 |
| Al ₂ O ₃ | 16.70 | 17.24 | 17.88 | Na ₂ O | 0.36 | | |
| Fe ₂ O ₃ | 1.28 | | | K ₂ O | 0.23 | | |
| FeO | 7.12 | 10.41 | 12.60 | H ₂ O ⁺ | 1.56 | [1.57] | 1.58 |
| MnO | 1.66 | 2.61 | | Total | 99.41 | [99.78] | 100.00 |

(1) Durango, Mexico. (2) Rosebery district, Tasmania, Australia; by electron microprobe, B₂O₃ interpolated from end members, H₂O calculated from stoichiometry. (3) Ca₂FeAl₂BSi₄O₁₅(OH).

Polymorphism & Series: Forms a series with manganaxinite.

Mineral Group: Axinite group; Ca > 1.5 per formula unit, Fe > Mn.

Occurrence: In low- to high-grade regionally metamorphosed rocks, in contact metamorphosed rocks, and in pegmatites.

Association: Prehnite, andradite, hedenbergite, zoisite, actinolite, datolite, tourmaline, vesuvianite, calcite, albite, quartz.

Distribution: Many localities, even for fine crystals. On Roscommon Cliff and in the Botallack mine, St. Just, Cornwall, England. From Bourg d'Oisans, Isère, France. In the Maderantal, Uri, Switzerland. Extraordinary crystals from the Puiva deposit, about 100 km west-northwest of Saranpaul, Subpolar Ural Mountains; at Zlatoust, Ural Mountains; and elsewhere in Russia. At Skardu, Pakistan. In the Obira mine, Bungo, Oita Prefecture; the Toroku mine, Miyazaki Prefecture; and elsewhere in Japan. In the USA, from Coarse Gold, Madera Co., near Yreka, Siskiyou Co., and New Melones Lake, Calaveras Co., California; and from Elkhorn, Jefferson Co., Montana. In Canada, found near Hope, British Columbia, and in the Moneta mine, Timmins, Ontario. From Trinidad, Baja California, Mexico. At Vitoria da Conquista, Bahia, Brazil.

Name: From the Greek for axe, referring to the common crystal shape, and for dominant FERROan iron, in a mineral of the *axinite* group.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 527–529. (2) Deer, W.A., R.A. Howie, and J. Zussman (1986) Rock-forming minerals, (2nd edition), v. 1B, disilicates and ring silicates, 603–623. (3) Milton, C., F.A. Hildebrand, and A.M. Sherwood (1953) The identity of tinzenite with manganoan axinite. *Amer. Mineral.*, 38, 1148–1158. (4) Swinnea, J.S., H. Steinfink, L.E. Rendon-DiazMiron, and S. Enciso de la Vega (1981) The crystal structure of a Mexican axinite. *Amer. Mineral.*, 66, 428–431.

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