

# Akaganéite

# $\beta$ -Fe<sup>3+</sup>O(OH, Cl)

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**Crystal Data:** Monoclinic. *Point Group:*  $2/m$ . Tiny spindlelike quasi-single crystals are up to 5  $\mu\text{m}$  in length; in bundles of such rods; commonly fine-grained massive to powdery.

**Physical Properties:** Hardness = n.d.  $D(\text{meas.}) = \text{n.d.}$   $D(\text{calc.}) = [3.52]$

**Optical Properties:** Semitransparent. *Color:* Yellowish brown.  
*Optical Class:* Biaxial.  $\alpha = \text{n.d.}$   $\beta = \text{n.d.}$   $\gamma = \text{n.d.}$   $2V(\text{meas.}) = \text{n.d.}$

**Cell Data:** *Space Group:*  $I2/m$ .  $a = 10.561(4)$   $b = 3.031(1)$   $c = 10.483(4)$   
 $\beta = 90.63(4)^\circ$   $Z = 8$

**X-ray Powder Pattern:** Synthetic FeO(OH).  
3.333 (100), 2.5502 (55), 7.467 (40), 2.2952 (35), 1.6434 (35), 5.276 (30), 2.6344 (25)

<b>Chemistry:</b>	(1)	(2)	(3)
SiO <sub>2</sub>	3.10		
Al <sub>2</sub> O <sub>3</sub>	1.21		
Fe <sub>2</sub> O <sub>3</sub>	78.23	69.0 – 76.0	89.86
FeO	0.82		
NiO		0.4 – 5.6	
Na <sub>2</sub> O	0.62		
K <sub>2</sub> O	0.19		
H <sub>2</sub> O <sup>+</sup>	10.20		10.14
H <sub>2</sub> O <sup>-</sup>	4.96		
Cl		3.6 – 6.3	
Total	99.33		100.00

(1) Akagané mine, Japan; Si and Al are probably impurities; other samples from the locality contain significant Cl. (2) Campo del Cielo Fe–Ni meteorite; by electron microprobe, ranges of 14 analyses, total Fe as Fe<sub>2</sub>O<sub>3</sub>; with O<sup>2+</sup> and (OH)<sup>1-</sup> for charge balance, the average corresponds to (Fe<sub>0.95</sub><sup>3+</sup>Ni<sub>0.05</sub>)<sub>Σ=1.00</sub>O<sub>0.79</sub>[(OH)<sub>1.21</sub>Cl<sub>0.16</sub>]<sub>Σ=1.37</sub>. (3) FeO(OH).

**Occurrence:** Apparently formed from pyrrhotite by ferric-sulfate-bearing solutions (Akagané mine, Japan); an important constituent in some soils, and certain geothermal brines and in sea-floor nodules; also formed as a corrosion product of some meteorites.

**Association:** Pyrrhotite (Akagané mine, Japan); hibbingite (Hibbing, Minnesota, USA).

**Distribution:** From the Akagané mine, Iwate Prefecture, Japan. Found at the Las Animas mine, La Mur, Trincheras, Sonora, Mexico. In the USA, from Black Rock, Humboldt Co., Nevada; north of the Santa Niño mine, Santa Cruz Co., Arizona; at Questa, Taos Co., New Mexico; and in the Duluth Gabbro complex, near Hibbing, St. Louis Co., Minnesota. At the Clara mine, near Oberwolfach, Black Forest, Germany. From Warham Marshes, Norfolk, England. At Richelle, Belgium. In brines from the Atlantis II Deep, Red Sea. Additional localities may be expected, as the mineral has the appearance of “limonite”.

**Name:** For the Akagané mine, Japan, its original locality.

**Type Material:** n.d.

**References:** (1) Mackay, A.L. (1962)  $\beta$ -ferric oxyhydroxide-akaganéite. *Mineral. Mag.*, 33, 270–280. (2) Buchwald, V.F. and R.S. Clarke, Jr. (1989) Corrosion of Fe–Ni alloys by Cl-containing akaganéite ( $\beta$ -FeOOH): the Antarctic meteorite case. *Amer. Mineral.*, 74, 656–667. (3) Post, J.E. and V.F. Buchwald (1991) Crystal structure refinement of akaganéite. *Amer. Mineral.*, 76, 272–277. (4) Murad, E. (1979) Mössbauer and X-ray data on  $\beta$ -FeOOH (akaganéite). *Clay Minerals*, 14, 273–284.

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