

Fluorarrojadite-(BaFe)

Crystal Data: Monoclinic. *Point Group:* m . As nodules in quartz to ~1 cm.

Physical Properties: *Cleavage:* On {001}. *Tenacity:* Brittle. *Fracture:* n.d. Hardness = 4-5
D(meas.) = n.d. D(calc.) = 3.650 Nonfluorescent.

Optical Properties: Transparent. *Color:* Light yellowish green. *Streak:* Dark yellowish green.
Luster: Vitreous.

Optical Class: Biaxial (+). $\alpha = 1.668(2)$ $\beta = 1.670(2)$ $\gamma = 1.682(2)$ $2V(\text{meas.}) = 37(2)^\circ$
 $2V(\text{calc.}) = 44.7^\circ$ *Dispersion:* None. *Orientation:* $X = b$, $Y \wedge c = 5(1)^\circ$. *Pleochroism:* Very weak,
 $X =$ very pale green, $Z =$ very pale yellow.

Cell Data: *Space Group:* Cc . $a = 16.4970(9)$ $b = 10.0176(5)$ $c = 24.6359(13)$ $\beta = 105.649(2)^\circ$ $Z = 4$

X-Ray Diffraction Pattern: Calculated pattern.

3.03 (100), 2.703 (68), 3.211 (48), 2.706 (39), 2.543 (38), 2.841 (34), 2.758 (33)

Chemistry:	(1)	(2)		(1)	(2)
P ₂ O ₅	[38.87]	38.52	SiO ₂	0.06	
Al ₂ O ₃	2.35	2.30	TiO ₂		
FeO	27.16	45.50	SrO	0.81	
MnO	12.91		BaO	4.39	6.94
ZnO	0.19		PbO	0.69	
MgO	1.52		F	0.89	1.72
Li ₂ O _{LAM}	0.33		H ₂ O	[0.81]	0.41
Na ₂ O	4.99	2.80	<u>-O = F</u>	<u>0.38</u>	
K ₂ O	0.59		Total	98.43	100.00
CaO	2.25	2.54			

(1) Sidi-bou-Kricha, Marrakech province, Morocco; average electron microprobe analysis, H₂O and P₂O₅ calculated. (2) $^{Al}\text{Ba}^{A2}\square^{B1}\text{Fe}^{B2}\square^{Na1,2}\text{Na}_2^{Na3}\square^{Ca}\text{Fe}_{13}\text{Al}(\text{PO}_4)_{11}^{Plx}(\text{PO}_3\text{OH})^W(\text{F})_2$.

Polymorphism & Series: Forms a series with dickinsonite.

Mineral Group: Arrojadite group. $\text{A}_2\text{B}_2\text{CaNa}_{2+x}\text{M}_{13}\text{Al}(\text{PO}_4)_{11}(\text{PO}_3\text{OH}_{1-x})\text{W}_2$.

Occurrence: A high-temperature ($\approx 800^\circ\text{C}$) primary mineral in granite pegmatites.

Association: Quartz.

Distribution: From near Sidi-bou-Kricha, Sidi-bou-Othmane township, Jebilet mountains, Marrakech province, Morocco [TL].

Name: *Arrojadite* indicates a member of the group with Fe²⁺ dominant at the *M* site; two suffixes indicate the dominant cation of the dominant valence state at the *A* and *B* sites. The prefix, *fluor*, indicates dominant F in the *W* site. Honors Miguel *Arrojado* Ribeiro Lisbôa (1872-1932), Brazilian geologist.

Type Material: Natural History Museum, Toulouse, France (MHNT.MIN.2006.38.1).

References: (1) Chopin, C., R. Oberti, and F. Cámara (2006) The arrojadite enigma: II. Compositional space, new members, and nomenclature of the group. *Amer. Mineral.*, 91, 1260-1270. (2) Cámara, F., R. Oberti, C. Chopin, and O. Medenbach (2006) The arrojadite enigma: I. A new formula and a new model for the arrojadite structure. *Amer. Mineral.*, 91, 1249-1259.