

Arrojadite-(SrFe)**SrFe²⁺(CaNa₂)Fe²⁺₁₃Al(PO₄)₁₁(PO₃OH)(OH)₂**

Crystal Data: Monoclinic. *Point Group:* *m*. As slightly elongated crystals, to several hundred μm .

Physical Properties: *Cleavage:* On {001}. *Tenacity:* Brittle. *Fracture:* n.d. *Hardness* = 3.5-4
D(meas.) = n.d. D(calc.) = 3.569 Nonfluorescent.

Optical Properties: Translucent. *Color:* Yellow to yellowish red. *Streak:* White.
Luster: Vitreous.

Optical Class: Biaxial (+). $\alpha = 1.654(1)$ $\beta = 1.657(2)$ $\gamma = 1.668(1)$ $2V(\text{meas.}) = 37(2)^\circ$ - $41(1)^\circ$
 $2V(\text{calc.}) = 55^\circ$ *Pleochroism:* Very weak, $X = Y = \text{colorless}$, $Z = \text{pale yellow}$. *Absorption:* $X \approx Y$.

Cell Data: *Space Group:* *Cc*. $a = 16.3992(7)$ $b = 9.9400(4)$ $c = 24.4434(11)$ $\beta = 105.489(1)^\circ$ $Z = 4$

X-Ray Diffraction Pattern: Calculated pattern.

3.009 (100), 2.685 (70), 3.192 (41), 2.805 (28), 2.738 (28), 3.378 (26), 2.820 (24)

Chemistry:	(1)	(2)		(1)	(2)
P ₂ O ₅	[40.74]	39.48	K ₂ O	0.06	
Al ₂ O ₃	2.46	2.36	CaO	1.58	2.60
SiO ₂	0.06		SrO	4.63	4.80
TiO ₂	0.01		BaO	1.48	
FeO	22.94	46.63	PbO	0.29	
MnO	11.34		F	0.82	
ZnO	0.28		H ₂ O	[0.91]	
MgO	7.00	1.25	<u>-O = F</u>	<u>0.35</u>	
Li ₂ O _{LAM}	0.006		Total	99.17	100.00
Na ₂ O	4.77	2.87			

(1) Horrsjöberg, Värmland, Sweden; average electron microprobe analysis, H₂O and P₂O₅ calculated; corresponds Sr_{0.93}Na_{3.20}(Ca_{0.59}Ba_{0.20}Pb_{0.03}K_{0.03}) $\Sigma=0.85$ (Fe²⁺_{6.64}Mg_{3.61}Mn²⁺_{3.33}Zn_{0.07}Li_{0.01}) $\Sigma=13.66$ (Al_{1.00}Sc_{0.04}) $\Sigma=1.04$ [(OH)_{1.10}F_{0.90}] $\Sigma=2.00$ [(P_{11.95}Si_{0.02}) $\Sigma=11.97$ O₄₇(OH)_{1.00}].

(2) SrFe²⁺(CaNa₂)Fe²⁺₁₃Al(PO₄)₁₁(PO₃OH)(OH)₂.

Polymorphism & Series: Forms a series with dickinsonite.

Mineral Group: Arrojadite group. A₂B₂CaNa_{2+x}M₁₃Al(PO₄)₁₁(PO₃OH_{1-x})W₂.

Occurrence: In metaquartzite formed under amphibolite facies conditions.

Association: Kyanite, muscovite, wagnerite, lazulite, rutile, quartz, fluorapatite.

Distribution: From Horrsjöberg, Värmland, Sweden [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. Honors Miguel Arrojado Ribeiro Lisbôa (1872-1932), Brazilian geologist.

Type Material: Mineral Museum, School of Mines, Paris, France (16926).

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.