Bendadaite $Fe^{2+}Fe^{3+}_2(AsO_4)_2(OH)_2 \cdot 4H_2O$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As tufts of crystals elongated along [001] to 1 mm.

Physical Properties: *Cleavage*: Good on {010}. *Fracture*: Irregular. *Tenacity*: Brittle. Hardness = ~3 D(meas.) = 3.15(10) D(calc.) = 3.193 Nonfluorescent.

Optical Properties: Translucent. *Color*: Blackish green to dark brownish. *Streak*: Greenish yellow. *Luster*: Vitreous to sub-adamantine.
Optical Class: Biaxial (+). $\alpha = 1.734(3)$ $\beta = 1.759(3)$ $\gamma = 1.787(4)$ 2V(meas.) = 85(4)º 2V(calc.) = 88º *Pleochroism*: Medium strong, *X* = pale reddish brown, *Y* = yellowish brown, *Z* = dark yellowish brown. *Absorption*: *Z* > *Y* > *X*. *Dispersion*: Weak, *r* > *v*. *Orientation*: Optical axis plane is parallel to (010), *X* approximately parallel to *a*, *Z* nearly parallel to *c*.

Cell Data: *Space Group*: $P2_1/c$. $a = 10.239(3)$ $b = 9.713(2)$ $c = 5.552(2)$ $\beta = 94.11(2)$º $Z = 2$

X-ray Powder Pattern: Bendada, Portugal.
10.22 (10), 7.036 (8), 4.250 (5), 2.865 (4), 4.833 (3), 2.907 (3), 4.520 (2)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
CaO	0.04			SnO_2	0.10		
MnO	0.03	0.57		As_2O_5	43.27	37.72	41.68
CuO	0.06			P_2O_5	1.86	5.40	
ZnO	0.04			SO_3	0.03		
FeO		10.07	13.03	H_2O	n.d.	18.60	16.33
Fe_2O_3	43.92	33.22	28.96	Total		106.30	100.00
Al_2O_3	1.15	0.72					

(1) Bendada, Portugal; average electron microprobe analysis, total Fe as Fe_2O_3; corresponds to $(Fe^{2+}_{0.95}\square_{0.14})_{\Sigma=1.00}(Fe^{3+}_{1.80}Al_{0.20})_{\Sigma=2.00}(As_{1.48}P_{0.52})_{\Sigma=2.00}O_8(OH)_2 \cdot 4H_2O$. (2) Almerindo mine, Brazil; average electron microprobe analysis, FeO and Fe_2O_3 from Mössbauer spectroscopy, H_2O by the Alimarin method; corresponds to $(Fe^{2+}_{0.69}Fe^{3+}_{0.13}Mn_{0.04}\square_{0.05})_{\Sigma=1.00}(Fe^{3+}_{1.93}Al_{0.07})_{\Sigma=2.00}(As_{1.62}P_{0.38})_{\Sigma=2.00}O_8(OH)_{1.82} \cdot 4.18H_2O$. (3) $Fe^{2+}Fe^{3+}_2(AsO_4)_2(OH)_2 \cdot 4H_2O$.

Mineral Group: Arthurite group.

Occurrence: From the dumps of phosphate-bearing columbite-beryl pegmatite; a secondary (or late-hydrothermal) mineral with Fe and As derived from weathered arsenopyrite.

Association: Scorodite-mansfieldite, gypsum (Bendada); albite, muscovite, quartz, schorl, elbaite, löllingite, scorodite, pharmacosiderite, saléeite, phosphuranylite; arsenopyrite, erythrite, pharmacosiderite, parasymplesite, karibibite, scorodite, 'limonite' (Almerindo mine).

Distribution: From the dumps of the pegmatite at Bendada, near Guarda, province Beira Alta, central Portugal [TL]. At the granite pegmatite of Almerindo mine, Linópolis, Divino das Laranjeiras county, Minas Gerais, Brazil [TL]. From the Veta Negra mine, Copiapó province, Chile; Oumlil-East, Bou Azzer district, Morocco; and Pira Inferida yard, Fenugu Sibiri mine, Gonnosfanadiga, Medio Campidano Province, Sardinia, Italy.

Name: For the occurrence in Portugal at *Bendada*.

Type Material: Natural History Museum, Vienna, Austria (N 8160) and the Geosciences Museum, University of São Paulo, Brazil (DR625).

References: (1) Kolitsch U., D. Atencio, N.V. Chukanov, N.V. Zubkova, L.A.D. Menezes, J.M.V. Coutinho, W.D. Birch, J. Schlüter, D. Pohl, A.R. Kampf, I.M. Steele, G. Favreau, L. Nasdala, S. Möckel, G. Giester, and D.Y. Pushcharovsky (2010) Bendadaite, a new iron arsenate mineral of the arthurite group. Mineral. Mag., 74, 469-486. (2) Sejkora J, J. Tvrdý, J. Čejka, L. Vrtiška, and Z. Dolníček (2019) Bendadaite from Krásno near Horní Slavkov (Czech Republic), description and Raman spectroscopy. Bull. Mineral.-Petrologického Oddelení Národního Muzea (Praha) 27, 63-71.