Durangite $NaAl(AsO_4)F$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Typically in euhedral crystals, to 1 cm, slightly elongated along [001], with dominant {110}, {$\overline{1}$11}, and {010}, {100}, {021}, faces commonly rough; in stacked aggregates.

Physical Properties: *Cleavage:* On {110}, distinct. *Fracture:* Uneven to conchoidal. *Tenacity:* Brittle. Hardness = 5–5.5 D(meas.) = 3.90–4.07 D(calc.) = 3.92

Optical Properties: Transparent to opaque. *Color:* Pale to dark red-orange, deep red, orange, orange-brown, pale yellow; in transmitted light, color zoned from varying contents of Fe and Mn. *Streak:* Cream-yellow to pale yellow. *Luster:* Vitreous, usually dull.
Optical Class: Biaxial (–). *Pleochroism:* X = yellow-orange; Y = pale yellow-orange; Z = nearly colorless. *Orientation:* $Z = b$; $X \wedge c = -25°$. *Dispersion:* $r < v$, less commonly $r > v$, weak to moderate. *Absorption:* $X > Y > Z$. α = 1.597–1.634 β = 1.636–1.673 γ = 1.647–1.685 2V(meas.) = 45°; 68°–85° 2V(calc.) = 55°–81°

Cell Data: *Space Group:* $C2/c$. a = 6.574–6.579 b = 8.505–8.523 c = 7.019–7.046 β = 115.34°−115.47° Z = 4

X-ray Powder Pattern: Barranca tin mine, Durango, Mexico.
2.967 (100), 4.76 (80), 3.236 (80), 2.560 (60), 2.549 (57), 3.34 (50), 1.533 (41)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
As_2O_5	53.11	54.0	55.28	Li_2O	0.65	0.46	
TiO_2		0.15		Na_2O	13.06	13.7	14.91
Al_2O_3	17.19	21.5	24.52	F	7.67	8.16	9.14
Fe_2O_3	9.23	2.83		Cl		< 0.2	
Mn_2O_3	2.08	2.38		H_2O^+		0.30	
ZnO		0.18		H_2O^-		0.05	
PbO		0.1		$-O = F_2$	3.23	3.44	3.85
CaO		0.11		Total	99.76	100.48	100.00

(1) Barranca tin mine, Durango, Mexico. (2) Boiler Peak, New Mexico, USA; by ICPA and emission spectroscopy, F by ion chromatography, H_2O by Karl Fischer method, after deduction of SiO_2 3.21%; then corresponds to $(Na_{0.93}Li_{0.07})_{\Sigma=1.00}(Al_{0.89}Fe_{0.07}Mn_{0.06})_{\Sigma=1.02}(As_{0.99}O_4)[F_{0.90}(OH)_{0.07}]_{\Sigma=0.97}$. (3) $NaAl(AsO_4)F$.

Polymorphism & Series: Forms two series, with maxwellite and with tilasite.

Occurrence: In veins in alkalic rhyolite and tin placers derived therefrom; in pegmatite dikes in granite.

Association: Cassiterite, hematite, topaz, ilmenite, tantalite, wickmanite, beudantite, mimetite, fluorite, tridymite, cristobalite, quartz, amblygonite, "chalcedony", zeolites, clay minerals.

Distribution: From the Barranca tin mine, about 30 km northeast of Coneto de Comonfort, Durango, Mexico. Found near Lake Ramsey, New Ross, Nova Scotia, Canada. In the USA, in tin prospects near Boiler Peak, in the Black Range, Sierra Co., New Mexico; and in the Thomas Range, Juab Co., Utah. From the Cheesewring quarry, Linkinhorne, Cornwall, England.

Name: For the original occurrence in Durango, Mexico.

Type Material: Yale University, New Haven, Connecticut, USA, 3.586, 3.3036, 3.3037.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 829–831. (2) Foord, E.E., M.R. Oakman, and C.H. Maxwell (1985) Durangite from the Black Range, New Mexico, and new data on durangite from Durango and Cornwall. Can. Mineral., 23, 241–246. (3) Kokkoros, P. (1938) Über die Struktur des Durangit $NaAlF[AsO_4]$. Zeits. Krist., 99, 38–49 (in German).