Brazilianite $NaAl_3(PO_4)_2(OH)_4$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Crystals typically equant, or spearhead-shaped, elongated along [100], with large {011}, {$\bar{1}$11}, also {010}, {110}, {$\bar{3}$01}, {$\bar{1}$01}, other forms, to 20 cm. May be radial fibrous, globular.

Physical Properties: *Cleavage:* On {010}, good. *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = 5.5 D(meas.) = 2.98 D(calc.) = 2.998

Optical Properties: Transparent. *Color:* Chartreuse-yellow, pale yellow, yellow-green; colorless in transmitted light. *Streak:* White. *Luster:* Vitreous.
Optical Class: Biaxial (+). *Orientation:* $Y = b$; $X \wedge c = -20°$. *Dispersion:* $r < v$, faint.
$\alpha = 1.602$ $\beta = 1.609$ $\gamma = 1.621$–1.623 2V(meas.) = n.d. 2V(calc.) = 71°–75°

Cell Data: *Space Group:* $P2_1/n$. $a = 11.229(6)$ $b = 10.142(5)$ $c = 7.098(4)$ $\beta = 97°41'$
Z = 4

X-ray Powder Pattern: Palermo #1 mine, New Hampshire, USA.
5.04 (10), 2.98 (8), 2.73 (8), 2.68 (8), 2.87 (7), 1.44 (5), 3.77 (4)

Chemistry:

	(1)	(2)
P_2O_5	37.97	39.22
Al_2O_3	43.82	42.26
Na_2O	8.42	8.56
K_2O	0.37	
H_2O	9.65	9.96
Total	100.23	100.00

(1) [Córrego Frio mine,] Brazil. (2) $NaAl_3(PO_4)_2(OH)_4$.

Occurrence: A hydrothermal mineral in phosphate-rich zones of granite pegmatites; also in metamorphosed sedimentary deposits.

Association: Muscovite, albite, apatite, tourmaline ([Córrego Frio mine,] Brazil); whitlockite, apatite, quartz (Palermo #1 mine, New Hampshire, USA); amblygonite, lazulite-scorzalite, augelite, bertossaite, apatite (Buranga pegmatite, Rwanda).

Distribution: In Brazil, from the Córrego Frio and other nearby pegmatite mines, Divino das Laranjeiras, near Linópolis, and from São Geraldo do Baixio, Minas Gerais; on Alto Patrimônio, near Pedro Lavrada, Paraíba; from Boqueirão del Parelhas and Alto do Giz, Rio Grande do Norte. In the USA, at the Palermo #1 and Fletcher mines, near North Groton, Grafton Co., and the G.E. Smith mine, Newport, Sullivan Co., New Hampshire; at the Bell Pit, Newry, Oxford Co., Maine; from the White Picacho district, Maricopa and Yavapai Co., Arizona. In the Big Fish River–Rapid Creek area, Yukon Territory, Canada. From the Buranga pegmatite, near Gatumba, Rwanda. At Millstätter Seenrücken, Carinthia, Austria. From Dolní Bory, near Velkého Meziříčí, Czech Republic. At Giogo di Toirano, Bardineto, Savona, Italy. From Hagendorf, Bavaria, Germany.

Name: For Brazil, the country in which it was first found.

Type Material: National Museum of Natural History, Washington, D.C., USA, 105048.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 841–843. (2) Frondel, C. and M.L. Lindberg (1948) Second occurrence of brazilianite. Amer. Mineral., 33, 135–141. (3) Gatehouse, B.M. and B.K. Miskin (1974) The crystal structure of brazilianite, $NaAl_3(PO_4)_2(OH)_4$. Acta Cryst., 30, 1311–1317.