Painite $CaZrAl_9O_{15}(BO_3)$

Crystal Data: Hexagonal. *Point Group*: 6/*m*. Elongated crystals, pseudo-orthorhombic, showing {10*0}, {11*0}, {12*0}, {13*0}, {11*1}, {11*2}, {11*3}, {20*1}, {10*1}, and {00*1}, to 1.5 cm.

Physical Properties: Hardness = ~8 D(meas.) = 4.01-4.03 D(calc.) = 3.996-4.020

Optical Properties: Transparent. *Color*: Deep garnet-red, brownish red-orange.
Optical Class: Uniaxial (–). $\omega = 1.8159$ $\varepsilon = 1.7875$ *Pleochroism*: Ruby-red || [00*1]; pale brownish orange or pale red-orange ⊥ [00*1].

Cell Data: *Space Group*: $P6_3/m$. $a = 8.724(1)$ $c = 8.464(2)$ Z = 2

X-ray Powder Pattern: Near Ohngaing, Myanmar.
5.76 (vs), 2.520 (vs), 3.70 (s), 2.370 (s), 2.008 (s), 1.726 (ms), 1.423 (ms)

Chemistry:

	(1)	(2)	(3)
B_2O_3	n.d.	5.23	5.17
ZrO_2	18.77	16.89	18.31
HfO_2		0.32	
Al_2O_3	69.02	66.03	68.19
V_2O_3		0.09	
Cr_2O_3		0.05	
CaO	7.17	6.81	8.33
Na_2O		0.46	
TiO_2		1.69	
H_2O	n.d.		.
Total	94.96	97.57	100.00

(1) Near Ohngaing, Myanmar; by electron microprobe, B determined present by wet chemical analysis, IR, and crystal-structure analysis. (2) Do., laser-ablation inductively-coupled plasma mass spectrometric analysis; corresponds to $Ca_{0.77}Na_{0.19}Al_{8.80}Ti_{0.19}Cr_{0.03}V_{0.01}Zr_{0.94}Hf_{0.01}B_{1.06}O_{18}$.
(3) $CaZrAl_9O_{15}(BO_3)$.

Occurrence: In gem gravels.

Association: Corundum, phlogopite.

Distribution: From near Ohngaing village, Sagaing, Mogok district, Myanmar (Burma).

Name: For Arthur Charles Davy *Pain* (1901-1971), British gem collector, who first noted the species.

Type Material: The Natural History Museum, London, England, 1954,192; National Museum of Natural History, Washington, D.C., USA, 142506.

References: (1) Claringbull, G.F., M.H. Hey, and C.J. Payne (1957) Painite, a new mineral from Mogok, Burma. Mineral. Mag., 31, 420-425. (2) (1957) Amer. Mineral., 42, 580 (abs. ref. 1). (3) Moore, P.B. and T. Araki (1976) Painite, $CaZrB[Al_9O_{18}]$: its crystal structure and relation to jeremejevite, $B_5[\square_3Al_6(OH)_3O_{15}]$, and fluoborite, $B_3[Mg_9(F, OH)_9O_9]$. Amer. Mineral., 61, 88-94. (4) Shigley, J.E., A.R. Kampf, and G.R. Rossman (1986) New data on painite. Mineral. Mag., 50, 267-270. (5) Armbruster, T., N. Döbelin, A. Peretti, D. Günther, E. Reusser, and B. Grobéty (2004) The crystal structure of painite $CaZrB[Al_9O_{18}]$ revisited. Amer. Mineral., 89, 610-613.