

**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 (-).  $\omega = 1.8159$   $\epsilon = 1.7875$  *Pleochroism:* Ruby-red || [00\*1]; pale brownish orange or pale red-orange  $\perp$  [00\*1].

**Cell Data:** *Space Group:* P6<sub>3</sub>/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)

<b>Chemistry:</b>	(1)	(2)	(3)
B <sub>2</sub> O <sub>3</sub>	n.d.	5.23	5.17
ZrO <sub>2</sub>	18.77	16.89	18.31
HfO <sub>2</sub>		0.32	
Al <sub>2</sub> O <sub>3</sub>	69.02	66.03	68.19
V <sub>2</sub> O <sub>3</sub>		0.09	
Cr <sub>2</sub> O <sub>3</sub>		0.05	
CaO	7.17	6.81	8.33
Na <sub>2</sub> O		0.46	
TiO <sub>2</sub>		1.69	
<u>H<sub>2</sub>O</u>	<u>n.d.</u>		
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<sub>0.77</sub>Na<sub>0.19</sub>Al<sub>8.80</sub>Ti<sub>0.19</sub>Cr<sub>0.03</sub>V<sub>0.01</sub>Zr<sub>0.94</sub>Hf<sub>0.01</sub>B<sub>1.06</sub>O<sub>18</sub>.

(3) CaZrAl<sub>9</sub>O<sub>15</sub>(BO<sub>3</sub>).

**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<sub>9</sub>O<sub>18</sub>]: its crystal structure and relation to jeremejevite, B<sub>5</sub>[□<sub>3</sub>Al<sub>6</sub>(OH)<sub>3</sub>O<sub>15</sub>], and fluorborite, B<sub>3</sub>[Mg<sub>9</sub>(F, OH)<sub>9</sub>O<sub>9</sub>]. *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. Grobóty (2004) The crystal structure of painite CaZrB[Al<sub>9</sub>O<sub>18</sub>] revisited. *Amer. Mineral.*, 89, 610-613.