

**Crystal Data:** Orthorhombic. *Point Group:*  $2/m\ 2/m\ 2/m$ . Crystals prismatic, may be acicular, with square cross sections, rounded and striated, poorly terminated, to 2 cm; as fibrous mats; rarely radiating.

**Physical Properties:** *Cleavage:* Perfect on {010}. *Fracture:* Uneven. *Tenacity:* Tough in aggregate. Hardness = 6.5–7.5  $D(\text{meas.}) = 3.23\text{--}3.24$   $D(\text{calc.}) = [3.24]$

**Optical Properties:** Transparent to translucent. *Color:* Colorless or white to gray, also brown, yellow, yellow-green, gray-green, blue-green, blue; colorless in thin section. *Streak:* White.

*Luster:* Vitreous to subadamantine.

*Optical Class:* Biaxial (+). *Pleochroism:* If colored,  $X =$  pale brown or pale yellow;  $Y =$  brown or green;  $Z =$  dark brown or blue. *Orientation:*  $X = a$ ;  $Y = b$ ;  $Z = c$ . *Dispersion:*  $r > v$ , strong.  $\alpha = 1.653\text{--}1.661$   $\beta = 1.657\text{--}1.662$   $\gamma = 1.672\text{--}1.683$   $2V(\text{meas.}) = 21^\circ\text{--}30^\circ$

**Cell Data:** *Space Group:*  $Pbnm$ .  $a = 7.4883(7)$   $b = 7.6808(7)$   $c = 5.7774(5)$   $Z = 4$

**X-ray Powder Pattern:** Custer, Custer Co., South Dakota, USA.

3.42 (100), 3.37 (65), 2.204 (60), 2.541 (40), 2.679 (30), 2.111 (20), 5.36 (16)

**Chemistry:**

	(1)
SiO <sub>2</sub>	37.08
Al <sub>2</sub> O <sub>3</sub>	63.11
Fe <sub>2</sub> O <sub>3</sub>	0.09
Total	100.28

(1) Delaware Co., Pennsylvania, USA; corresponds to Al<sub>2.00</sub>Si<sub>1.00</sub>O<sub>5</sub>.

**Polymorphism & Series:** Trimorphous with kyanite and andalusite.

**Occurrence:** In high-grade metamorphic schists, gneisses, and hornfels; more rarely in pegmatites. Also as a detrital mineral.

**Association:** Andalusite, kyanite, potassic feldspar, almandine, cordierite, biotite, quartz.

**Distribution:** Of widespread occurrence, but fine examples are uncommon. From the Lisens Alp, Selraintal, Tirol, Austria. At Marsšová (Marschendorf), Czech Republic. From Bodenmais, Bavaria, Germany. At Pontgibaud, Auvergne, France. In the USA, from Chester, near Saybrook, Middlesex Co., and near Norwich, New London Co., Connecticut; from Chester, Delaware Co., Pennsylvania; at Monroe, Orange Co., New York. In the Okkampitiya, Ratnapura, Deniyaya, and Balangoda districts, Sri Lanka, as gem crystals. At Christmas Point, Enderby Land, Antarctica.

**Name:** For Professor Benjamin Silliman (1779–1864), Professor of Chemistry and Mineralogy, Yale University, New Haven, Connecticut, USA.

**References:** (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 498–499. (2) Deer, W.A., R.A. Howie, and J. Zussman (1982) Rock-forming minerals, (2nd edition), v. 1A, orthosilicates, 719–741. (3) Althaus, E. (1969) Das System Al<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub>–H<sub>2</sub>O. Experimentelle Untersuchungen und Folgerungen für die Petrogenese der metamorphen Gesteine. Neues Jahrb. Mineral., Abh., 111, 74–110 (in German). (4) Winter, J.K. and S. Ghose (1979) Thermal expansion and high-temperature crystal chemistry of the Al<sub>2</sub>SiO<sub>5</sub> polymorphs. Amer. Mineral., 64, 573–586.