

**Crystal Data:** Hexagonal; may be metamict. *Point Group:*  $\bar{3}$ . Rough crystals, tabular or acute rhombohedra; in rounded fragments, to several cm. *Twinning:* By rotation around [0001], forming cyclic interpenetrant trillings; on {52 $\bar{7}$ 0}.

**Physical Properties:** *Fracture:* Conchoidal. *Tenacity:* [Brittle.] *Hardness* = > 6  
D(meas.) = 5.204–5.301 D(calc.) = [5.23] May be radioactive.

**Optical Properties:** Opaque, may be transparent in very thin fragments. *Color:* Black; oil-green to greenish black in transmitted light. *Streak:* Brownish black. *Luster:* Submetallic. *Optical Class:* Uniaxial (-); low birefringence.  $\omega$  = 2.50 (Li).  $\epsilon$  = n.d.  
R<sub>1</sub>–R<sub>2</sub>: n.d.

**Cell Data:** *Space Group:*  $R\bar{3}$ .  $a$  = 10.393(2)  $c$  = 20.811(5)  $Z$  = 3

**X-ray Powder Pattern:** Dattas, Brazil.

2.894 (100), 3.43 (90), 1.981 (75), 1.603 (70), 1.447 (70), 2.468 (50), 2.265 (50)

| <b>Chemistry:</b>              | (1)   | (2)   | (1)          | (2)           |
|--------------------------------|-------|-------|--------------|---------------|
| Nb <sub>2</sub> O <sub>5</sub> |       | 0.22  | FeO          | 21.99         |
| TiO <sub>2</sub>               | 50.32 | 54.88 | MnO          | 17.58         |
| ThO <sub>2</sub>               | 0.84  | 0.3   | ZnO          | 0.53          |
| Y <sub>2</sub> O <sub>3</sub>  |       | 3.55  | PbO          | 9.62          |
| La <sub>2</sub> O <sub>3</sub> |       | 0.65  | MgO          | 0.15          |
| Ce <sub>2</sub> O <sub>3</sub> |       | 0.60  | BaO          | 0.3           |
| Fe <sub>2</sub> O <sub>3</sub> |       | 25.48 | SrO          | 1.1           |
| Cr <sub>2</sub> O <sub>3</sub> |       | 0.10  |              |               |
|                                |       |       | <u>Total</u> | <u>100.35</u> |
|                                |       |       |              | 100.27        |

(1) Currálinho, Brazil. (2) Dattas, Brazil; by electron microprobe, average of four analyses, total Fe as Fe<sub>2</sub>O<sub>3</sub>, total Mn as MnO; corresponding to (Pb<sub>0.76</sub>Sr<sub>0.20</sub>La<sub>0.08</sub>Ce<sub>0.07</sub>Ba<sub>0.04</sub>) $\Sigma=1.15$  (Ti<sub>12.89</sub>Fe<sub>5.99</sub><sup>3+</sup>Mn<sub>0.88</sub>Y<sub>0.59</sub>Zn<sub>0.12</sub>Mg<sub>0.07</sub>Nb<sub>0.03</sub>Cr<sub>0.02</sub>Th<sub>0.02</sub>) $\Sigma=20.61$ O<sub>38</sub>.

**Mineral Group:** Crichtonite group.

**Occurrence:** In granite or syenite pegmatites; in a hydrothermal deposit; a detrital mineral.

**Association:** Ilmenite, rutile, magnetite, hematite.

**Distribution:** In Brazil, from a number of occurrences in the Diamantina district, as at Datas; Currálinho; Santa Quitéria; Imbiruçu; Vargeas; Rio Cipó; Riacho das Varas; and elsewhere in Minas Gerais [some may be crichtonite]. From Wannigletscher, Binntal, and near Collonges, Valais, Switzerland. On Pizzo Cervandone, Alpe Devero, Val d'Aosta, and at Cuneo, Piedmont, Italy. At Alinci and Nezilovo, Macedonia. From near Tvedalen, Norway. In the Mangruvan Fe–Mn deposit, near Guldsmedshyttan, Örebro, Sweden. In the USA, from St. Peters Dome, near Pikes Peak, El Paso Co., Colorado. At Mont Saint-Hilaire, Quebec, Canada.

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**Type Material:** The Natural History Museum, London, England, 83656, 86037; National Museum of Natural History, Washington, D.C., USA, R7241.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 541–542. (2) Rouse, R.C. and D.R. Peacor (1968) The relationship between senaite, magnetoplumbite, and davidite. *Amer. Mineral.*, 53, 869–879. (3) Grey, I.E. and D.J. Lloyd (1976) The crystal structure of senaite. *Acta Cryst.*, 32, 1509–1513. (4) Foord, E.E., W.N. Sharp, and J.W. Adams (1984) Zinc- and Y-group-bearing senaite from St Peters Dome, and new data on senaite from Dattas, Minas Gerais, Brazil. *Mineral. Mag.*, 48, 97–106.

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