

**Cervandonite-(Ce)****(Ce, Nd, La)(Fe<sup>3+</sup>, Ti, Fe<sup>2+</sup>, Al)<sub>3</sub>(Si, As)<sub>3</sub>O<sub>13</sub>**

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**Crystal Data:** Monoclinic. *Point Group:*  $m$ , 2, or  $2/m$ . As porous, saddle- or rosettelike, rounded, radial crystal aggregates, to 4 mm.

**Physical Properties:** *Cleavage:* {001}, poor. *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = 5 VHN = 450 (50 g load). D(meas.) = n.d. D(calc.) = 4.9

**Optical Properties:** Opaque, translucent in very thin fragments. *Color:* Black; in transmitted light, yellowish, reddish brown to black. *Streak:* Brownish black. *Luster:* Adamantine. *Optical Class:* Biaxial. *Pleochroism:* Yellowish, reddish brown to black.  $n = 1.99\text{--}2.00$  2V(meas.) = n.d.

**Cell Data:** *Space Group:*  $Cm$ ,  $C2$ , or  $C2/m$ .  $a = 11.235(4)$   $b = 19.50(2)$   $c = 7.201(3)$   $\beta = 121.22(3)^\circ$   $Z = 6$

**X-ray Powder Pattern:** Pizzo Cervandone, Italy.

2.8785 (100), 3.2530 (90), 5.390 (80), 3.0847 (80), 2.7867 (60), 2.6964 (50), 3.5750 (40)

| <b>Chemistry:</b>              | (1)   | (2)   | (1)                            | (2)              |
|--------------------------------|-------|-------|--------------------------------|------------------|
| SiO <sub>2</sub>               | 17.65 | 15.17 | Ce <sub>2</sub> O <sub>3</sub> | 10.00            |
| TiO <sub>2</sub>               | 11.67 | 11.42 | Nd <sub>2</sub> O <sub>3</sub> | 5.16             |
| SnO <sub>2</sub>               | 1.24  | 0.00  | Fe <sub>2</sub> O <sub>3</sub> | 15.03            |
| UO <sub>2</sub>                | 1.35  | 0.33  | As <sub>2</sub> O <sub>5</sub> | 20.41            |
| ThO <sub>2</sub>               | 2.34  | 1.92  | FeO                            | 4.51             |
| Al <sub>2</sub> O <sub>3</sub> | 3.60  | 2.95  | PbO                            | 0.17             |
| Y <sub>2</sub> O <sub>3</sub>  | 0.94  | 0.86  | CaO                            | 0.25             |
| La <sub>2</sub> O <sub>3</sub> | 5.14  | 5.65  | Total                          | [99.46] [100.73] |

(1) Pizzo Cervandone, Italy; by electron microprobe, Fe<sup>2+</sup>:Fe<sup>3+</sup> determined by Mössbauer spectroscopy, original total given as 99.47%; corresponds to (Ce<sub>0.39</sub>Nd<sub>0.20</sub>La<sub>0.20</sub>Y<sub>0.05</sub>Th<sub>0.06</sub>U<sub>0.03</sub>Ca<sub>0.03</sub>Pb<sub>0.01</sub>)<sub>Σ=0.97</sub>(Fe<sub>1.21</sub><sup>3+</sup>Ti<sub>0.94</sub>Al<sub>0.46</sub>Fe<sub>0.40</sub><sup>2+</sup>Sn<sub>0.05</sub>)<sub>Σ=3.06</sub>(Si<sub>1.89</sub>As<sub>1.14</sub><sup>3+</sup>)<sub>Σ=3.03</sub>O<sub>13</sub>. (2) Pizzo Cervandone, Switzerland; by electron microprobe, original total given as 100.72%; corresponds to (Ce<sub>0.46</sub>Nd<sub>0.23</sub>La<sub>0.23</sub>Y<sub>0.05</sub>Th<sub>0.05</sub>Ca<sub>0.03</sub>U<sub>0.01</sub>Pb<sub>0.01</sub>)<sub>Σ=1.07</sub>(Fe<sub>1.26</sub><sup>3+</sup>Ti<sub>0.93</sub>Fe<sub>0.42</sub><sup>2+</sup>Al<sub>0.38</sub>)<sub>Σ=2.99</sub>(Si<sub>1.64</sub>As<sub>1.36</sub><sup>3+</sup>)<sub>Σ=3.00</sub>O<sub>13</sub>.

**Occurrence:** In narrow fissure-veins cutting two-mica gneiss.

**Association:** Senaite, chernovite, rutile, anatase, muscovite, albite, chlorite, tourmaline, magnetite, hematite, quartz, synchysite.

**Distribution:** On the east flank of Pizzo Cervandone, Alpe Devero, Val d'Aosta, Italy. On the west flank of Cherbadung [Pizzo Cervandone], Binntal, Valais, Switzerland.

**Name:** After the locality on the border between Italy and Switzerland where the mineral was discovered, Pizzo Cervandone.

**Type Material:** Natural History Museum, Bern, B3953, B4695, B4880; Natural History Museum, Basel, Switzerland, M30802.

**References:** (1) Armbruster, T., C. Bühler, S. Graeser, H.A. Stalder, and G. Amthauer (1988) Cervandonite-(Ce), (Ce, Nd, La)(Fe<sup>3+</sup>, Fe<sup>2+</sup>, Ti<sup>4+</sup>, Al)<sub>3</sub>SiAs(Si, As)O<sub>13</sub>, a new Alpine fissure mineral. Schweiz. Mineral. Petrog. Mitt., 68, 125–132. (2) (1990) Amer. Mineral., 75, 932 (abs. ref. 1).