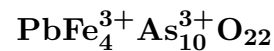


# Ludlockite



©2001-2005 Mineral Data Publishing, version 1

**Crystal Data:** Triclinic. *Point Group:*  $\bar{1}$ . Commonly as simply terminated laths, elongated along [100], and flattened on  $\{0\bar{1}1\}$ , less commonly prismatic with almost equant cross sections, to 4 cm; may be slightly twisted. In divergent bundles of such hairlike crystals. *Twinning:* Lamellar twinning on  $\{0\bar{1}1\}$ , common.

**Physical Properties:** *Cleavage:* Perfect micaceous on  $\{0\bar{1}1\}$ , perfect on  $\{021\}$ .  
*Tenacity:* Very flexible and sectile. Hardness = 1.5–2 D(meas.) = 4.33–4.40 D(calc.) = 4.58

**Optical Properties:** Semitransparent. *Color:* Red, red-brown, orange-brown, yellow.  
*Streak:* Pale brown. *Luster:* Subadamantine.  
*Optical Class:* Biaxial (+). *Pleochroism:* X = yellow; Y = deep yellow; Z = yellow-orange.  
*Orientation:*  $Z \wedge a \simeq 3^\circ$ . *Absorption:*  $Z > Y > X$ .  $\alpha = 1.96$   $\beta = 2.055$   $\gamma = > 2.11$   
 $2V(\text{meas.}) = \text{n.d.}$

**Cell Data:** *Space Group:*  $P\bar{1}$ .  $a = 10.426(4)$   $b = 11.972(5)$   $c = 9.894(4)$   $\alpha = 113.76(3)^\circ$   
 $\beta = 99.83(3)^\circ$   $\gamma = 82.50(3)^\circ$   $Z = 2$

**X-ray Powder Pattern:** Tsumeb, Namibia.  
8.81 (vvs), 2.935 (vs), 3.330 (ms), 3.160 (ms), 2.863 (ms), 10.90 (m), 4.74 (mb)

Chemistry:	(1)	(2)	(3)
As <sub>2</sub> O <sub>5</sub>	70.82		
Fe <sub>2</sub> O <sub>3</sub>	21.63	19.96	20.85
As <sub>2</sub> O <sub>3</sub>		60.67	64.58
PbO	9.32	14.41	14.57
H <sub>2</sub> O	0.00		
–O	1.69		
Total	100.08	95.04	100.00

(1) Tsumeb, Namibia; predominant Fe<sup>3+</sup> confirmed by Mössbauer spectroscopy, total As as As<sub>2</sub>O<sub>5</sub>. (2) Do.; by electron microprobe, total Fe as Fe<sub>2</sub>O<sub>3</sub>, total As as As<sub>2</sub>O<sub>3</sub>, both confirmed by crystal-structure analysis; corresponding to Pb<sub>1.04</sub>Fe<sub>4.04</sub><sup>3+</sup>As<sub>9.93</sub><sup>3+</sup>O<sub>22</sub>. (3) PbFe<sub>4</sub><sup>3+</sup>As<sub>10</sub><sup>3+</sup>O<sub>22</sub>.

**Occurrence:** In sulfide ore from a complex polymetallic hydrothermal ore deposit (Tsumeb, Namibia).

**Association:** Zincian siderite, tennantite, chalcocite, pyrite, bornite, germanite, quartz; leiteite, reniérite, stolzite, schneiderhöhnite (Tsumeb, Namibia).

**Distribution:** From Tsumeb, Namibia. At Laurium, Greece, in slag. From one km north of Campiglia, Tuscany, Italy, in slag. At Zarehehuran, near Takap, Takht-e-Suleiman massif, Azerbaijan.

**Name:** For Fredrick LUDlow Smith III, (1939– ) and Charles LOCKE Key (1935– ), American mineral dealers then resident in New Jersey, USA, who supplied the first specimens for study.

**Type Material:** The Natural History Museum, London, England, 1969,215 and 216; Harvard University, Cambridge, Massachusetts, USA, 127927.

**References:** (1) Embrey, P.G., M.H. Hey, and R.J. Davis (1977) Ludlockite: a new mineral from Tsumeb. *Mineral. Record*, 8(3), 91–94. (2) Cooper, M.A. and F.C. Hawthorne (1996) The crystal structure of ludlockite, PbFe<sub>4</sub><sup>3+</sup>As<sub>10</sub><sup>3+</sup>O<sub>22</sub>, the mineral with pentameric arsenite groups and orange hair. *Can. Mineral.*, 34, 79–89.