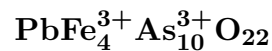


Ludlockite



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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(meas.) = 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 ₂ O ₅	70.82		
Fe ₂ O ₃	21.63	19.96	20.85
As ₂ O ₃		60.67	64.58
PbO	9.32	14.41	14.57
H ₂ O	0.00		
–O	1.69		
Total	100.08	95.04	100.00

(1) Tsumeb, Namibia; predominant Fe³⁺ confirmed by Mössbauer spectroscopy, total As as As₂O₅. (2) Do.; by electron microprobe, total Fe as Fe₂O₃, total As as As₂O₃, both confirmed by crystal-structure analysis; corresponding to Pb_{1.04}Fe_{4.04}³⁺As_{9.93}³⁺O₂₂. (3) PbFe₄³⁺As₁₀³⁺O₂₂.

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, PbFe₄³⁺As₁₀³⁺O₂₂, the mineral with pentameric arsenite groups and orange hair. Can. Mineral., 34, 79–89.