

**Ludlamite****(Fe<sup>2+</sup>, Mg, Mn<sup>2+</sup>)<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>·4H<sub>2</sub>O**

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**Crystal Data:** Monoclinic. *Point Group:* 2/m. As crystals, usually tabular {001}, showing {100}, {110}, {001}, {111}, others, to 9 cm, may be in parallel groups; granular, massive.

**Physical Properties:** *Cleavage:* {001}, perfect; {100}, indistinct. *Hardness* = 3.5  
D(meas.) = 3.12–3.19 D(calc.) = 3.176

**Optical Properties:** Translucent. *Color:* Apple-green to bright green; nearly colorless in transmitted light. *Streak:* Pale greenish white. *Luster:* Vitreous, pearly on {001} cleavage. *Optical Class:* Biaxial (+). *Orientation:* Y = b; Z ∧ c = -67°. *Dispersion:* r > v, perceptible. α = 1.650–1.653 β = 1.669–1.675 γ = 1.688–1.697 2V(meas.) = 82°

**Cell Data:** *Space Group:* P2<sub>1</sub>/a. a = 10.541(5) b = 4.646(4) c = 9.324(5)  
β = 100°25.8(1.0)' Z = 2

**X-ray Powder Pattern:** Wheal Jane, England. (ICDD 17-468).  
3.96 (100), 2.765 (100), 2.543 (100), 4.91 (75), 2.990 (60), 3.74 (50), 2.387 (40)

<b>Chemistry:</b>	(1)	(2)
P <sub>2</sub> O <sub>5</sub>	32.95	33.04
FeO	49.22	50.18
MgO	0.96	
H <sub>2</sub> O	16.12	16.78
insol.	0.57	
Total	99.82	100.00

(1) Palermo #1 mine, New Hampshire, USA. (2) Fe<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>·4H<sub>2</sub>O.

**Occurrence:** In complex granite pegmatites, a common hydrothermal alteration product of earlier phosphates, formed under reducing conditions.

**Association:** Phosphoferrite, triploidite, triplite, triphylite, apatite (Hagendorf, Germany); fairfieldite, vivianite, siderite, whitlockite (Palermo #1 mine, New Hampshire, USA).

**Distribution:** Some localities for fine crystals or large masses include: from Wheal Jane, Kea, Cornwall, England. At Hagendorf, Bavaria, Germany. From the Stari Trg mine (Trepča), Kosovo, Serbia. In the USA, at the Palermo #1 mine, North Groton, Grafton Co., New Hampshire; large crystals from the Blackbird mine, Lemhi Co., Idaho; at the Dan Patch, Ferguson, Big Chief, and other pegmatites, near Keystone, Pennington Co., South Dakota. From the Rapid Creek district, Yukon Territory, Canada. Large crystals from the San Antonio mine, Santa Eulalia district, Chihuahua, Mexico. In the Énio pegmatite mine, northeast of Galiléia, Minas Gerais, Brazil. Fine crystals from Morococala and Huanuni, Oruro, Bolivia. In the Ashio mine, Tochigi Prefecture, Japan. A number of other localities are known.

**Name:** To honor Henry Ludlam (1824–1880), English mineral collector, London, England.

**Type Material:** The Natural History Museum, London, England, 44187.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 952–953. (2) Abrahams, S.C. and J.L. Bernstein (1966) Crystal structure of paramagnetic ludlamite, Fe<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>·4H<sub>2</sub>O, at 298°K. J. Chemical Physics, 44(6), 2223–2229.