Lahnsteinite $Zn_4(SO_4)(OH)_6 \cdot 3H_2O$

Crystal Data: Triclinic (pseudo-orthorhombic). *Point Group*: 1. As hexagonal tabular crystals, to 0.7 mm, displaying {001}, {00$\bar{1}$ }, {110}, {130}, {010}, {$\bar{1}$ $\bar{1}$ 0}, {$\bar{1}$ $\bar{3}$ 0}, and {0$\bar{1}$ 0}.

Physical Properties: *Cleavage*: Perfect on {001}, 2 more less-perfect sets perpendicular to (001). *Fracture*: n.d. *Tenacity*: Sectle. Hardness = 1.5 D(meas.) = 2.98(2) D(calc.) = 2.995

Optical Properties: Translucent. *Color*: Colorless. *Streak*: n.d. *Luster*: n.d.
Optical Class: Biaxial (–). α = 1.568(2) β = 1.612(2) γ = 1.613(2) 2V(meas.) = 18(3)° 2V(calc.) = 17° *Orientation*: $X \sim c$, $Y \sim b$, $Z \sim a$. *Dispersion*: None.

Cell Data: *Space Group*: *P*1. a = 8.312(1) b = 14.545(1) c = 18.504(2) α = 89.71(1)° β = 90 05(1)° γ = 90 13(1)° Z = 8

X-ray Powder Pattern: Friedrichssegen mine, near Lahnstein, Rhineland-Palatinate, Germany. 9.30 (100), 2.723 (57), 2.624 (36), 2.503 (35), 1.574 (23), 3.476 (19), 3.290 (19)

Chemistry:

	(1)
FeO	3.87
CuO	1.68
ZnO	57.85
SO_3	15.83
H_2O	22.3
Total	101.53

(1) Friedrichssegen mine, near Lahnstein, Rhineland-Palatinate, Germany; average of 6 electron microprobe analyses, H_2O by gas chromatography; corresponding to $(Zn_{3.53}Fe_{0.27}Cu_{0.11})_{\Sigma=3.91}(S_{0.98}O_4)(OH)_6 \cdot 3H_{2.10}O$.

Occurrence: In the oxidized zone of a hydrothermal polymetallic sulfide deposit.

Association: Hydrozincite, pyromorphite, native copper, goethite.

Distribution: From dumps at the Friedrichssegen mine, near Lahnstein, Ems District, Rhineland-Palatinate (Rheinland-Pfalz), Germany.

Name: For the city nearby the locality from which the first specimens were collected.

Type Material: A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia (4352/1).

References: (1) Chukanov, N.V., R.K. Rastsvetaeva, S.M. Aksenov, I.V. Pekov, D.I. Belakovskiy, G. Blass, and G. Möhn (2013) Lahnsteinite, $Zn_4(SO_4)(OH)_6 \cdot 3H_2O$, a new mineral species from the Friederichssegen Mine, Germany. Zap. Ross. Mineral. Obshch., 142(1), 39-46 (in Russian, with English abstract). (2) Rastsvetaeva, R.K., S.M. Aksenov, N.V. Chukanov, and I.A. Verin (2012) Crystal structure of a new mineral lahnsteinite $Zn_4(SO_4)(OH)_6 \cdot 3H_2O$. Kristallografiya, 57, 5, 825-829 (in Russian). With English translation: Crystallography Reports (2012), 57(5) 737-741.
(3) (2014) Amer. Mineral., 99, 246 (abs. refs. 1 and 2).