

Crystal Data: Tetragonal. *Point Group:* $4/m\ 2/m\ 2/m$, $\bar{4}2m$, $4mm$, 422 , $4/m$, $\bar{4}$, or 4 . In very fine-grained, concentrically-layered, botryoidal crusts and masses.

Physical Properties: *Fracture:* Conchoidal. *Hardness* = 4.5 *D(meas.)* = 3.71–4.01 *D(calc.)* = [3.75]

Optical Properties: Opaque. *Color:* Iron-black to chocolate-brown; light gray to yellowish gray in reflected light. *Streak:* Brown. *Luster:* Dull.

Optical Class: Uniaxial. *Anisotropism:* Strong. *Bireflectance:* Weak.

R_1 – R_2 : n.d.

Cell Data: *Space Group:* $P4/mmm$, $P\bar{4}2m$, $P\bar{4}m2$, $P4mm$, $P422$, $P4/m$, $P\bar{4}$, or $P4$. $a = 8.42$ $c = 9.28$ $Z = [4]$

X-ray Powder Pattern: Sandur, India.

4.66 (10), 2.66 (6), 2.48 (6), 9.34 (5), 1.48 (5), 1.86 (4), 1.69 (4)

Chemistry:	(1)	(2)		(1)	(2)
SiO ₂	0.86	1.28	BaO	0.12	0.62
MnO ₂	64.27	68.29	Na ₂ O	0.06	0.04
Al ₂ O ₃	0.14	0.96	K ₂ O	0.55	0.08
Fe ₂ O ₃	0.26	0.89	H ₂ O ⁺		8.48
MnO	7.88	8.46	H ₂ O [−]		0.83
ZnO	13.89	9.42	H ₂ O	10.48	
MgO	0.62	0.48	<hr/>		
			Total	99.13	[99.83]

(1) Sterling Hill, New Jersey, USA; Mn²⁺:Mn⁴⁺ calculated from stoichiometry. (2) Sandur, India; original total given as 99.84%.

Occurrence: In the oxidized portion of a metamorphosed stratiform zinc orebody (Sterling Hill, New Jersey, USA); in massive manganese ores (Sandur, India); in the oxidized zone of a Ag–Pb–Zn ore deposit (Lardeau, Canada); a component of ocean-floor Fe–Mn nodules.

Association: Franklinites, chalcophanite (Sterling Hill, New Jersey, USA); pyrolusite, cryptomelane (Sandur, India); smithsonite, gunningite, hydrozincite, aurichalcite (Lardeau, Canada).

Distribution: From Sterling Hill, Ogdensburg, Sussex Co., New Jersey, USA. At the Willett mine, Lardeau, British Columbia, Canada. From the Lecht mine, near Tomintoul, Aberdeenshire, Scotland. On Mont Chemin, Valais, Switzerland. From Maria Weitschach, near Hüttenberg, Carinthia, Austria. In Germany, at Juliushütte, Astfeld, Harz Mountains, in slag. From Sandur, Mysore, India.

Name: To honor Samuel Woodruff, American miner for the New Jersey Zinc Company, and prolific mineral collector of Franklin–Sterling Hill minerals.

Type Material: Harvard University, Cambridge, Massachusetts, USA, 112987.

References: (1) Frondel, C. (1953) New manganese oxides: hydrohausmannite and woodruffite. *Amer. Mineral.*, 38, 761–769. (2) Naganna, C. and V. Bouška (1963) X-ray study of woodruffite from Sandur ore deposits, Mysore State, India. *Mineral. Mag.*, 33, 506–507.