

Crystal Data: Monoclinic, pseudotetragonal. *Point Group:* 2/m. Crystals short prismatic with flat pyramidal termination, to several cm; radial fibrous, massive. *Twining:* Common on {101} or {10 $\bar{1}$ }.

Physical Properties: *Cleavage:* Prismatic, distinct. *Tenacity:* Brittle. Hardness = 6 VHN = 488–560 || [001], 620–689 \perp [001] (100 g load). D(meas.) = 4.95 D(calc.) = [4.93]

Optical Properties: Opaque. *Color:* Black, grayish black to silvery gray; in reflected light, white. *Streak:* Black. *Luster:* Metallic, splendent.

Optical Class: Biaxial. *Pleochroism:* Weak. *Anisotropism:* Strong.

R₁–R₂: (400) 31.3–37.7, (420) 31.2–37.4, (440) 31.1–37.1, (460) 30.5–36.5, (480) 29.7–35.9, (500) 29.1–35.0, (520) 28.5–34.2, (540) 27.8–33.1, (560) 27.1–32.2, (580) 26.6–31.5, (600) 26.3–30.9, (620) 26.1–30.4, (640) 25.8–30.0, (660) 25.6–29.5, (680) 25.3–29.0, (700) 25.0–28.4

Cell Data: *Space Group:* I2/m. a = 10.013(1) b = 2.8801(2) c = 9.733(1)
 $\beta = 90.970(4)^\circ$ Z = 1

X-ray Powder Pattern: Langenberg, Germany; easily mistaken for coronadite.
3.13 (10), 2.40 (9), 3.47 (8), 2.15 (8), 1.55 (7), 1.83 (6), 6.98 (5)

Chemistry:	(1)	(2)	(1)	(2)
SiO ₂		0.58	MnO	5.12
MnO ₂	65.63	62.91	PbO	4.45
Al ₂ O ₃	0.94	1.45	BaO	17.59
Fe ₂ O ₃	10.56	12.63	Na ₂ O	0.58
Mn ₂ O ₃		4.57	K ₂ O	0.23
			Total	99.84 [101.21]

(1) Kajlidongri, India; corresponds to Ba_{0.95}[Mn_{6.23}⁴⁺Mn_{0.59}²⁺(Fe, Al)_{1.24}] _{$\Sigma=8.06$} O₁₆. (2) Stuur Njvoskes, Sweden; by electron microprobe, average of several analyses, Mn⁴⁺:Mn³⁺ calculated for charge balance; corresponds to (Ba_{0.75}Pb_{0.16}Na_{0.10}K_{0.04}) _{$\Sigma=1.05$} (Mn_{6.08}⁴⁺Fe_{1.32}³⁺Mn_{0.50}³⁺Al_{0.23}Si_{0.08}) _{$\Sigma=8.21$} O₁₆.

Mineral Group: Cryptomelane group.

Occurrence: A primary mineral in contact metamorphic manganese ores, and a secondary weathering product of earlier manganese-bearing minerals.

Association: Bixbyite, braunite, piemontite, other manganese oxides.

Distribution: In India, at Kajlidongri and Sitapar, Chhindwara district, Madhya Pradesh; in the Nagpur and Balaghat districts, Maharashtra; at Banswara, Rajasthan; and elsewhere. From Sörhårrås, Ultevis, Sweden. In Norway, from Tangen, Hurdal. At Langenberg, Saxony, Germany. From Inken, Tiovine region, Morocco. In the USA, in the Artillery Mountains, Mohave Co., and in the Apache mine, Sierra Ancha district, Gila Co., Arizona.

Name: For Dr. Thomas Henry Holland (1868–1947), Director of the Indian Geological Survey.

Type Material: n.d.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 743–744. (2) Frondel, C. and E.W. Heinrich (1942) new data on hetaerolite, hydrohetaerolite, coronadite, and hollandite. *Amer. Mineral.*, 27, 48–56. (3) Frondel, C., U.B. Marvin, and J. Ito (1960) New data on birnessite and hollandite. *Amer. Mineral.*, 45, 871–875. (4) Post, J.E., R.B. Von Dreele, and P.R. Buseck (1982) Symmetry and cation displacements in hollandites: structure refinements of hollandite, cryptomelane, and priderite. *Acta Cryst.*, 38, 1056–1065. (5) Miura, H. (1987) The crystal structure of hollandite. *Mineral. J. (Japan)*, 13, 119–129, 397–398. (6) Post, J.E. and D.L. Bish (1989) Rietveld refinement of crystal structures using powder X-ray diffraction data. In: D.L. Bish and J.E. Post, Eds., *Modern powder diffraction. Reviews in mineralogy*, vol. 20, 277–308, esp. 296–300.