

Lipuite **$\text{KNa}_8\text{Mn}^{3+}_5\text{Mg}_{0.5}[\text{Si}_{12}\text{O}_{30}(\text{OH})_4](\text{PO}_4)\text{O}_2(\text{OH})_2 \cdot 4\text{H}_2\text{O}$**

Crystal Data: Orthorhombic. *Point Group:* 2/m 2/m 2/m. As platy, tabular, or granular crystals to 3 mm.

Physical Properties: *Cleavage:* n.d. *Tenacity:* Brittle. *Fracture:* Uneven. Hardness = ~5
D(meas.) = 2.83(3) D(calc.) = 2.845

Optical Properties: Transparent. *Color:* Dark red-brown, bright red to dark red in thin section.
Streak: Red. *Luster:* Vitreous.
Optical Class: Biaxial (+). $\alpha = 1.635(1)$ $\beta = 1.653(1)$ $\gamma = 1.670(1)$ $2V(\text{meas.}) = 86(2)^\circ$
Dispersion: $v > r$.

Cell Data: *Space Group:* Pnmn. $a = 9.080(3)$ $b = 12.222(3)$ $c = 17.093(5)$ $Z = 2$

X-ray Powder Pattern: N'Chwaning III mine, Northern Cape Province, Republic of South Africa. 2.895 (100), 2.713 (53), 9.965 (40), 1.534 (40), 2.777 (38), 2.086 (35), 2.938 (33)

Chemistry:	(1)	(2)
Na ₂ O	15.23	15.46
K ₂ O	2.89	3.21
Mn ₂ O ₃	24.25	23.03
Fe ₂ O ₃		0.35
MgO	1.24	1.10
SiO ₂	44.30	43.95
P ₂ O ₅	4.36	4.07
H ₂ O	7.74	[7.74]
Total	100.00	98.91

(1) $\text{KNa}_8\text{Mn}^{3+}_5\text{Mg}_{0.5}[\text{Si}_{12}\text{O}_{30}(\text{OH})_4](\text{PO}_4)\text{O}_2(\text{OH})_2 \cdot 4\text{H}_2\text{O}$. (2) N'Chwaning III mine, Northern Cape Province, Republic of South Africa; average electron microprobe analysis supplemented by Raman spectroscopy, H₂O calculated; corresponds to $\text{K}_{1.12}\text{Na}_{8.16}(\text{Mn}_{4.77}\text{Fe}_{0.07})_{\Sigma=4.84}\text{Mg}_{0.44}[\text{Si}_{11.97}\text{O}_{30}(\text{OH})_4](\text{PO}_4)_{0.94}\text{O}_2(\text{OH})_2 \cdot 4\text{H}_2\text{O}$.

Occurrence: In high-grade Wessels-type Mn ore, mainly hausmannite, bixbyite, braunite-II, and manganite, formed by structurally controlled hydrothermal enrichment of low-grade strataform beds.

Association: Mn-bearing sugilite, taniajacoite, pectolite, richterite, norrishite, namansilite.

Distribution: From the N'Chwaning III mine, Kalahari Manganese Fields, Northern Cape Province, Republic of South Africa.

Name: Honors Chinese geochemist and petrologist, Professor Pu Li (1911-1968), Beijing Institute of Geology and later at the Guiyang Institute of Geochemistry, Chinese Academy of Sciences. Professor Li was the founder and pioneer of isotope geochemistry in China and made significant contributions to the development of Chinese geology and petrology.

Type Material: Mineral Museum, University of Arizona, Tucson, Arizona, USA (20010) and the RRUFF Project (R140946).

References: (1) Gu, X., H. Yang, X. Xie, J.J. Van Nieuwenhuizen, R.T. Downs, and S.H. Evans (2019) Lipuite, a new manganese phyllosilicate mineral from the N'Chwaning III mine, Kalahari Manganese Fields, South Africa. *Mineral. Mag.*, 83, 645-654.