Mianningite $(\square,Pb,Ce,Na)(U^{4+},Mn,U^{6+})Fe^{3+}_2(Ti,Fe^{3+})_{18}O_{38}$

Crystal Data: Hexagonal. *Point Group*: $\bar{3}$. As tabular crystals to 2 cm.

Physical Properties: *Cleavage*: None. *Tenacity*: Brittle. *Fracture*: Conchoidal. Hardness = ~ 6 VHN = 72.2-89.2 (200 g load). D(meas.) = 4.62(8) D(calc.) = 4.77 Partially metamict.

Optical Properties: Opaque. *Color*: Black; grayish white in reflected light. *Streak*: Black. *Luster*: Submetallic.
Optical Class: n.d. Weakly anisotropic.
R_1-R_2: (400) 18.6-16.4, (420) 19.9-18.9, (440) 19.8-18.9, (460) 19.2-18.5, (480) 18.8-18.1, (500) 18.5-17.9, (520) 18.2-17.6, (540) 18.0-17.4, (560)17.7-17.1, (580) 17.5-16.9, (600) 17.3-16.7, (620)17.1-16.5, (640)17.0-16.3, (660) 16.8-16.1, (680) 16.8-16.1, (700) 16.5-15.7

Cell Data: *Space Group*: $R\bar{3}$. a = 10.3462(5) c = 20.837(2) Z = 3

X-ray Powder Pattern: Baozi Hill, Mianning county, Sichuan province, China.
2.627 (100), 2.144 (100), 3.065 (75), 2.254 (70), 1.545 (60), 2.883 (55), 2.476 (55)

Chemistry:	(1)		(1)
P_2O_5	0.03	Y_2O_3	0.55
V_2O_5	0.57	La_2O_3	0.67
Nb_2O_5	0.59	Ce_2O_3	1.12
SiO_2	0.02	Nd_2O_3	0.11
TiO_2	53.12	MgO	0.05
ZrO_2	0.15	CaO	0.03
ThO_2	0.15	MnO	1.11
UO_2	[6.44]	SrO	0.20
UO_3	[1.71]	BaO	0.30
Al_2O_3	0.07	PbO	2.56
Cr_2O_3	0.07	Na_2O	0.21
FeO	[0.93]	K_2O	0.09
Fe_2O_3	[27.75]	Total	98.60

(1) Baozi Hill, Mianning county, Sichuan province, China; average of 22 electron microprobe analyses, UO_2, UO_3, FeO and Fe_2O_3 calculated from UO_2 total and Fe_2O_3 total and XPS data; corresponds to $[\square_{0.322}(Pb_{0.215}Ba_{0.037}Sr_{0.036}Ca_{0.010})_{\Sigma=0.298}(Ce_{0.128}La_{0.077}Nd_{0.012})_{\Sigma=0.217}(Na_{0.127}K_{0.036})_{\Sigma=0.163}]_{\Sigma=1.000}(U^{4+}_{0.447}Mn_{0.293}U^{6+}_{0.112}Y_{0.091}Zr_{0.023}Th_{0.011})_{\Sigma=0.977}(Fe^{3+}_{1.224}Fe^{2+}_{0.243}Mg_{0.023}P_{0.008}Si_{0.006}\square_{0.496})_{\Sigma=2.000}(Ti_{12.464}Fe^{3+}_{5.292}V^{5+}_{0.118}Nb_{0.083}Al_{0.026}Cr^{3+}_{0.017})_{\Sigma=18.000}O_{38}$.

Mineral Group: Crichtonite group.

Occurrence: In fractures within lamprophyre veins and their contacts with a later quartz-alkali feldspar syenite dike containing *REE*, U, and Th mineralization.

Association: Microcline, albite, quartz, iron-rich phlogopite, augite, muscovite, calcite, barite, fluorite, epidote, magnetite, hematite, galena, hydroxylapatite, titanite, ilmenite, rutile, garnet-group minerals, zircon, allanite-(Ce), monazite-(Ce), bastnasite-(Ce), parasite-(Ce), maoniupingite-(Ce), thorite, pyrochlore-group minerals, chlorite.

Distribution: From Baozi Hill, near the Maoniuping *REE* mine, Mianning county, Sichuan province, China.

Name: For the county in China that provided the first specimens.

Type Material: Geological Museum of China, Beijing, China (M12189).

References: (1) Xiangkun Ge, Guang Fan, Guowu Li, Ganfu Shen, Zhangru Chen, and Yujie Ai (2017) Mianningite, $(\square,Pb,Ce,Na)(U^{4+},Mn,U^{6+})Fe^{3+}_2(Ti,Fe^{3+})_{18}O_{38}$, a new member of the crichtonite group from Maoniuping *REE* deposit, Mianning county, southwest Sichuan, China. Eur. J. Mineral., 29(2), 331-338. (2) (2018) Amer. Mineral., 103, 334-335 (abs. ref. 1).