

**Crystal Data:** Monoclinic. *Point Group:* *m*. As prisms with chisel-like terminations to ~0.3 mm, elongated along [010] that display {100}, {001}, and {120}.

**Physical Properties:** *Cleavage:* Perfect on {001}. *Tenacity:* Brittle. *Fracture:* n.d. Hardness = n.d. D(meas.) = n.d. D(calc.) = n.d.

**Optical Properties:** Transparent. *Color:* Deep violet-brown. *Streak:* n.d. *Luster:* Vitreous. *Optical Class:* Biaxial (-).  $\alpha = 1.615(3)$   $\beta = 1.750(5)$   $\gamma = 1.765(5)$   $2V(\text{meas.}) = 37(1)^\circ$   $2V(\text{calc.}) = 34.6^\circ$  *Orientation:*  $X \approx c^*$ ,  $Y = b$ ,  $Z \approx a$ ,  $X \wedge c \approx 9^\circ$  in obtuse angle  $\beta$ . *Dispersion:* Strong,  $r > v$ . *Pleochroism:* Strong,  $X = \text{colorless}$ ,  $Y = \text{red-brown}$ ,  $Z = \text{deep violet}$ . *Absorption:*  $X \ll Y < Z$ .

**Cell Data:** *Space Group:* *Cm*.  $a = 7.1015(12)$   $b = 11.7489(17)$   $c = 8.1954(14)$   $\beta = 98.087(14)^\circ$   $Z = 2$

**X-ray Powder Pattern:** Clara mine, Black Forest Mountains, Baden-Württemberg, Germany. 8.10 (100), 3.420 (54), 2.015 (32), 4.06 (31), 3.518 (30), 3.083 (26), 3.237 (22)

<b>Chemistry:</b>	(1)
MgO	4.20
CuO	0.12
U <sub>2</sub> O <sub>5</sub>	[27.28]
UO <sub>3</sub>	[56.12]
F	5.87
H <sub>2</sub> O	[6.80]
- O = F <sub>2</sub>	2.47
Total	97.92

(1) Clara mine, Black Forest Mountains, Baden-Württemberg, Germany; average of 6 electron microprobe analyses supplemented by Raman spectroscopy, H<sub>2</sub>O calculated from structure, total U as UO<sub>3</sub> = 84.18 apportioned by structural data to U<sub>2</sub>O<sub>5</sub> and UO<sub>3</sub>; corresponds to (Mg<sub>1.06</sub>Cu<sub>0.02</sub>) $\Sigma=1.08$ [U<sup>5+</sup>(U<sup>6+</sup>O<sub>2</sub>)<sub>2</sub>O<sub>3.85</sub>F<sub>3.15</sub>][(H<sub>2</sub>O)<sub>3.69</sub>(OH)<sub>0.31</sub>] $\Sigma=4.00$ .

**Occurrence:** Formed by precipitation from U-containing aqueous solutions under partially reducing conditions most probably enhanced by consumption of oxygen during the oxidation of abundant pyrite present in the gangue.

**Association:** Fluorite, barite.

**Distribution:** From the dump of the Clara mine, Black Forest Mountains, Baden-Württemberg, Germany.

**Name:** Honors two German mineral collectors who found this new mineral. It combines the first four letters of their surnames: Markus *Noller* (b. 1977) and Reinhard *Motzigemba* (b. 1952).

**Type Material:** Natural History Museum of Los Angeles County, Los Angeles, California, USA (66647, 66648 and 66649).

**References:** (1) Plášil, J., A.R. Kampf, R. Škoda, and J. Čejka (2018) Nollmotzite, Mg[U<sup>V</sup>(U<sup>VI</sup>O<sub>2</sub>)<sub>2</sub>O<sub>4</sub>F<sub>3</sub>]·4H<sub>2</sub>O, the first natural uranium oxide containing fluorine. *Acta Crystal.*, B74(4), 362-369. (2) (2021) *Amer. Mineral.*, 106, 163 (abs. ref. 1).