

## Dugganite

## $\text{Pb}_3(\text{Zn, Cu})_3\text{Te}^{6+}\text{O}_6(\text{AsO}_4)(\text{OH})_3$

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**Crystal Data:** Hexagonal. *Point Group:*  $6/m\ 2/m\ 2/m$ . Crystals stubby prismatic, slightly curved, with  $\{0001\}$ ,  $\{11\bar{2}0\}$ ,  $\{11\bar{2}1\}$ , to 0.3 mm.

**Physical Properties:** *Cleavage:*  $\{11\bar{2}0\}$ , poor. *Fracture:* Brittle. Hardness = 3  
D(meas.) = 6.33(15) D(calc.) = 6.33

**Optical Properties:** Semitransparent. *Color:* Colorless, water-green, yellow-green, may be zoned or sectoried. *Streak:* White. *Luster:* Adamantine.

*Optical Class:* Uniaxial (-), anomalously slightly biaxial.  $\omega = 1.977(2)$   $\epsilon = 1.967$   
2V(meas.) = Small.

**Cell Data:** *Space Group:*  $P6/mmm$ .  $a = 8.472(5)$   $c = 5.208(5)$   $Z = 1$

**X-ray Powder Pattern:** Tombstone, Arizona, USA.

3.284 (10), 2.997 (8), 2.446 (6), 1.896 (6), 1.603 (6), 2.773 (5), 1.177 (5)

### Chemistry:

	(1)	(2)
TeO <sub>3</sub>	14.0	14.26
As <sub>2</sub> O <sub>5</sub>	10.4	9.33
CuO	1.2	
ZnO	17.6	19.83
PbO	55.3	54.38
H <sub>2</sub> O	1.5	2.20
Total	[100.0]	100.00

(1) Tombstone, Arizona, USA; average of four analyses for Pb, Zn, Cu, three for Te, and two for As, H<sub>2</sub>O by the Penfield method; recalculated to 100% after deduction of insoluble 3.63% average.

(2)  $\text{Pb}_3\text{Zn}_3(\text{TeO}_6)(\text{AsO}_4)(\text{OH})_3$ .

**Occurrence:** An alteration product of khinite and parakhinite, formed under acid oxidizing conditions from gold-telluride ores in massive vein quartz (Tombstone, Arizona, USA).

**Association:** Khinite, parakhinite, bromargyrite, chlorargyrite, cerussite, emmonsite, other tellurium oxysalts (Tombstone, Arizona, USA).

**Distribution:** In the USA, from the Emerald and Old Guard mines, and the Joe shaft, Tombstone, Cochise Co., Arizona; at the Centennial Eureka mine, Tintic district, Juab Co., Utah. From the Moctezuma (Bambolla) mine, 12 km south of Moctezuma, Sonora, Mexico.

**Name:** To honor Marjorie Duggan (1927–), American analytical chemist, who first analyzed Te<sup>6+</sup> from nature.

**Type Material:** The Natural History Museum, London, England, 1980,544; Harvard University, Cambridge, Massachusetts, 119093; National Museum of Natural History, Washington, D.C., USA, 162207.

**References:** (1) Williams, S.A. (1978) Khinite, parakhinite, and dugganite, three new tellurates from Tombstone, Arizona. *Amer. Mineral.*, 63, 1016–1019.