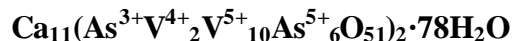


**Morrisonite**

**Crystal Data:** Monoclinic. *Point Group:* 2/m. As blades flattened on {010} and striated and elongated along [100] to 1 mm; and as subparallel or divergent aggregates.

**Physical Properties:** *Cleavage:* Perfect on {010} and good on {100}. *Tenacity:* Brittle.  
*Fracture:* Curved. Hardness = ~ 2.5 D(meas.) = 2.29(2) D(calc.) = 2.221  
 Dissolves in dilute HCl.

**Optical Properties:** Transparent. *Color:* Very dark blue. *Streak:* Grayish blue. *Luster:* Vitreous.  
*Optical Class:* Biaxial (-).  $\alpha = 1.611(2)$   $\beta(\text{calc.}) = 1.631$   $\gamma = 1.637(2)$   $2V(\text{meas.}) = 58(1)^\circ$   
 $2V(\text{calc.}) = \text{n.d.}$  *Orientation:*  $Y = b$ ,  $X \approx a$ ,  $Z \approx c$ . *Absorption:*  $X \ll Y \approx Z$ .  
*Pleochroism:*  $X = \text{blue}$ ,  $Y = \text{dark blue}$ ,  $Z = \text{dark blue}$ . *Dispersion:* None.

**Cell Data:** Space Group:  $P2_1/c$ .  $a = 14.9566(18)$   $b = 48.208(6)$   $c = 23.838(3)$   $\beta = 90.034(6)^\circ$   
 $Z = 4$

**X-ray Powder Pattern:** Packrat mine, Gateway district, Mesa County, Colorado, USA.  
 11.4 (100), 12.2 (69), 9.2 (23), 9.9 (16), 2.936 (16), 6.81 (12), 2.839 (12)

Chemistry:	(1)	(2)
Na <sub>2</sub> O	0.21	0.18
CaO	11.82	10.36
As <sub>2</sub> O <sub>3</sub>		[3.44]
As <sub>2</sub> O <sub>5</sub>	32.71	[24.63]
VO <sub>2</sub>		[5.14]
V <sub>2</sub> O <sub>5</sub>	42.79	[31.82]
H <sub>2</sub> O		[24.44]
Total	87.53	100.00

- (1) Packrat mine, Gateway district, Colorado, USA; average of 33 electron microprobe analyses.  
 (2) Analysis 1 normalized, H<sub>2</sub>O calculated from structure, As and V apportioned for charge balance and structural criteria; corresponds to  $(\text{Ca}_{10.61}\text{Na}_{0.34})_{\Sigma=10.95}(\text{As}^{3+}\text{V}^{4+}_{1.78}\text{V}^{5+}_{10.06}\text{As}^{5+}_{6.16}\text{O}_{51})_2 \cdot 78\text{H}_2\text{O}$ .

**Occurrence:** A secondary mineral formed by the oxidation of montroseite-corvusite assemblages in a moist environment.

**Association:** Gatewayite, packratite, vanarsite, pharmacolite, montroseite, corvusite.

**Distribution:** From the Packrat mine, Gateway district, Mesa County, Colorado, USA.

**Name:** For the Morrison Formation, in which the Packrat mine and other U-V mines of the Uravan mineral belt occur.

**Type Material:** Natural History Museum of Los Angeles County, Los Angeles, California, USA (64169, 65554 and 65556).

**References:** (1) Kampf, A.R., J.M. Hughes, B.P. Nash, and J. Marty (2016) Vanarsite, packratite, morrisonite, and gatewayite: four new minerals containing the  $[\text{As}^{3+}\text{V}^{4+,5+}_{12}\text{As}^{5+}_6\text{O}_{51}]$  heteropolyanion, a novel polyoxometalate cluster. *Can. Mineral.*, 54, 145-162. (2) (2017) *Amer. Mineral.*, 102, 1145-1146 (abs. ref. 1).