

**Crystal Data:** Monoclinic. *Point Group:* 2. As blades flattened on {101} and elongated along [010] to 0.5 mm; as crude prisms with curved faces, to 1 mm, and as composite crystals of subparallel narrow prisms to 2 mm.

**Physical Properties:** *Cleavage:* Fair on {010} and {101}. *Tenacity:* Brittle. *Fracture:* Curved. Hardness = ~2 D(meas.) = 2.34(2) D(calc.) = 2.337 Dissolves in dilute HCl.

**Optical Properties:** Transparent. *Color:* Very dark greenish blue. *Streak:* Grayish blue.

*Luster:* Vitreous.

*Optical Class:* Biaxial (-).  $\alpha = 1.621(1)$   $\beta = 1.654(5)$   $\gamma = 1.668(5)$   $2V(\text{meas.}) = 66(1)^\circ$

$2V(\text{calc.}) = 65^\circ$  *Orientation:*  $Y = b$ ,  $X \wedge a \approx 30^\circ$  in obtuse  $\beta$ . *Absorption:*  $X < Y < Z$ .

*Pleochroism:*  $X =$  pale olive green,  $Y =$  medium greenish blue,  $Z =$  dark greenish blue.

*Dispersion:* Extreme.

**Cell Data:** Space Group:  $P2_1$ .  $a = 11.1850(4)$   $b = 16.8528(4)$   $c = 20.7146(15)$   $\beta = 91.166(6)^\circ$   
 $Z = 2$

**X-ray Powder Pattern:** Packrat mine, Gateway district, Mesa County, Colorado, USA.

9.7 (100), 13.2 (47), 2.810 (17), 2.866 (14), 3.246 (9), 2.953 (9), 2.758 (9)

Chemistry:	(1)	(2)
Na <sub>2</sub> O	0.21	0.19
CaO	12.31	11.31
SrO	0.41	0.38
As <sub>2</sub> O <sub>3</sub>		[3.60]
As <sub>2</sub> O <sub>5</sub>	32.18	[25.40]
VO <sub>2</sub>		[7.40]
V <sub>2</sub> O <sub>5</sub>	42.97	[31.39]
H <sub>2</sub> O		[20.33]
Total	88.08	100.00

(1) Packrat mine, Gateway district, Colorado, USA; average of 9 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  $(\text{Ca}_{5.54}\text{Na}_{0.17}\text{Sr}_{0.10})_{\Sigma=5.81}(\text{As}^{3+}\text{V}^{4+}_{2.45}\text{V}^{5+}_{9.48}\text{As}^{5+}_{6.07}\text{O}_{51})\cdot 31\text{H}_2\text{O}$ .

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

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

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

**Name:** For the Gateway mining district in which the Packrat mine is located. Gateway is also the nearest town to the Packrat mine.

**Type Material:** Natural History Museum of Los Angeles County, Los Angeles, California, USA (64513, 64514, 65554, 65555 and 65559).

**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).