**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 =  $\sim 2.5$  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(calc.) = n.d. *Orientation*: Y = b,  $X \approx a$ ,  $Z \approx c$ . *Absorption*:  $X < Y \approx Z$ . *Pleochroism*: X = b blue, Y = a dark blue, X = a 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
$As_2O_3$		[3.44]
$As_2O_5$	32.71	[24.63]
$VO_2$		[5.14]
$V_2O_5$	42.79	[31.82]
$H_2O$		[24.44]
Total	87.53	100.00

- (1) Packrat mine, Gateway district, Colorado, USA; average of 33 electron microprobe analyses.
- (2) Analysis 1 normalized,  $H_2O$  calculated from structure, As and V apportioned for charge balance and structural criteria; corresponds to  $(Ca_{10.61}Na_{0.34})_{\Sigma=10.95}(As^{3+}V^{4+}_{1.78}V^{5+}_{10.06}As^{5+}_{6.16}O_{51})_2 \cdot 78H_2O$ .

**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 [As $^{3+}V^{4+,5+}_{12}As^{5+}_{6}O_{51}$ ] heteropolyanion, a novel polyoxometalate cluster. Can. Mineral., 54, 145-162. (2) (2017) Amer. Mineral., 102, 1145-1146 (abs. ref. 1).