Gatewayite $Ca_6(As^{3+}V^{4+}_3V^{5+}_9As^{5+}_6O_{51})\cdot 31H_2O$

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 (-). α =1.621(1) β = 1.654(5) γ = 1.668(5) 2V(meas.) = 66(1)° 2V(calc.) = 65° *Orientation*: $Y = b$, $X \wedge a \approx 30°$ in obtuse β. *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) β = 91.166(6)° 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_2O	0.21	0.19
CaO	12.31	11.31
SrO	0.41	0.38
As_2O_3		[3.60]
As_2O_5	32.18	[25.40]
VO_2		[7.40]
V_2O_5	42.97	[31.39]
H_2O		[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_2O calculated from structure, As and V apportioned for charge balance and structural criteria; corresponds to $(Ca_{5.54}Na_{0.17}Sr_{010})_{\Sigma=5.81}(As^{3+}V^{4+}_{2.45}V^{5+}_{9.48}As^{5+}_{6.07}O_{51})\cdot 31H_2O$.

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 $[As^{3+}V^{4+,5+}_{12}As^{5+}_6O_{51}]$ heteropolyanion, a novel polyoxometalate cluster. Can. Mineral., 54, 145-162. (2) (2017) Amer. Mineral., 102, 1145-1146 (abs. ref. 1).