

Vanalite

$\text{NaAl}_9\text{V}_{12}\text{O}_{42}(\text{OH})_4 \cdot 33\text{H}_2\text{O}$

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Crystal Data: Monoclinic. *Point Group:* $2/m$ or 2 . In poorly-formed flattened and ragged crystals, may have diamond-shaped outlines, to 0.02 mm.

Physical Properties: *Cleavage:* $\{010\}$, perfect; $\{100\}$, less so. Hardness = n.d.
D(meas.) = 2.3–2.4 D(calc.) = 2.15

Optical Properties: Semitransparent. *Color:* Bright yellow to yellow-orange. *Luster:* Waxy to vitreous.

Optical Class: Biaxial. *Pleochroism:* Slight; in shades of yellow. *Orientation:* Extinction parallel; elongation negative. $\alpha = 1.710(6)$ $\beta = \text{n.d.}$ $\gamma = 1.735(6)$ $2V(\text{meas.}) = \text{n.d.}$

Cell Data: *Space Group:* $P2_1/m$ or $P2_1$. $a = 12.470$ $b = 21.40$ $c = 10.825$ $\beta = 97^\circ$
 $Z = 2$

X-ray Powder Pattern: Kurumsak River valley, Kazakhstan.
10.70 (100), 2.938 (100), 8.52 (42), 7.90 (37), 6.33 (30), 5.34 (30), 3.308 (30)

Chemistry:	(1)	(2)
V_2O_5	47.10	49.34
V_2O_4	1.80	
SiO_2	trace	
Al_2O_3	21.00	20.75
Fe_2O_3	0.20	
MgO	trace	
CaO	trace	
Na_2O	1.40	1.40
H_2O^+	23.30	
H_2O^-	7.80	
H_2O		28.51
Total	[102.60]	100.00

(1) Kurumsak River valley, Kazakhstan; original total given as 99.40%; corresponds to $\text{Na}_{0.90}(\text{Al}_{8.18}\text{Fe}_{0.05}^{3+})_{\Sigma=8.23}(\text{V}_{10.29}^{5+}\text{V}_{0.43}^{4+})_{\Sigma=10.72}[\text{O}_{37}(\text{OH})_{4.76}]_{\Sigma=41.76} \cdot 30\text{H}_2\text{O}$.

(2) $\text{NaAl}_9\text{V}_{12}\text{O}_{42}(\text{OH})_4 \cdot 33\text{H}_2\text{O}$.

Occurrence: Incrusting joints and cavities in weathered shales.

Association: Steigerite, hewettite, delvauxite, satpaevite, gypsum, halloysite, montmorillonite, other clay minerals.

Distribution: From a prospect in the Kurumsak River valley, northwestern Kara-Tau Mountains, south Kazakhstan.

Name: For VANadium and ALuminum in the composition.

Type Material: Mining Institute, St. Petersburg, 1271/1; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 85613.

References: (1) Ankinovich, E.A. (1962) A new vanadium mineral, vanalite. *Zap. Vses. Mineral. Obshch.*, 91, 307–314 (in Russian). (2) (1963) *Amer. Mineral.*, 48, 1180 (abs. ref. 1). (3) Ankinovich, E.A., F.A. Kurmakaeva, and I.S. Zazubina (1987) Steigerite and vanalite from carbonaceous-siliceous vanadium-bearing formations of northwestern Karatau (southern Kazakhstan). *Zap. Vses. Mineral. Obshch.*, 116, 100–113 (in Russian with English abs.).