Alvanite $(Zn, Ni)Al_4(VO_3)_2(OH)_{12}\cdot 2H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. In hexagonal platelets, micalike, with forms {001}, {010}, {100}, and {101}. *Twinning:* Polysynthetic, ∥ {010}.

Physical Properties: *Cleavage:* Perfect on {010}. Hardness = 3–3.5 D(meas.) = 2.49 D(calc.) = 2.492

Optical Properties: Semitransparent. *Color:* Pale bluish green to bluish black. *Streak:* White. *Luster:* Vitreous, pearly on cleavages. *Optical Class:* Biaxial (–). *Orientation:* $X \wedge \{010\} = 14°$. *Dispersion:* $r < v$, strong. $\alpha = 1.658$ $\beta =$ n.d. $\gamma = 1.714$ 2V(meas.) = 80°–85°

Cell Data: *Space Group:* $P2_1/n$. $a = 17.808(8)$ $b = 5.132(3)$ $c = 8.881(4)$ $\beta = 92.11(3)°$ Z = 2

X-ray Powder Pattern: Kazakhstan.
4.46 (100), 8.91 (90), 7.85 (80), 5.02 (50), 1.973 (40), 3.287 (35), 2.957 (35)

Chemistry:

	(1)	(2)		(1)	(2)
V_2O_5	24.2	27.5	NiO	2.7	4.2
V_2O_4	3.8		ZnO	0.5	7.6
SiO_2	1.8		MgO	0.5	
Al_2O_3	39.5	34.2	CaO	0.5	
Fe_2O_3	trace		H_2O^+	25.4	
V_2O_3	0.0		H_2O^-	0.5	
FeO		0.3	H_2O		[26.2]
			Total	99.4	[100.0]

(1) Kazakhstan; several values are averages of two determinations. (2) Do.; by electron microprobe, H_2O by difference; corresponding to $(Zn_{0.57}Ni_{0.34}Fe_{0.02})_{\Sigma=0.93}Al_{4.09}V_{1.84}O_{20.50}H_{17.69}$.

Occurrence: In the oxidation zone of a vanadiferous clay-anthraxolite horizon.

Association: Mica, roscoelite (?).

Distribution: In several mines of the Kurumsak and Balasauskandyk districts, northwestern Kara-Tau Mountains, Kazakhstan.

Name: For ALuminum and VANadium in the composition.

Type Material: Mining Institute, St. Petersburg, 1249/2; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 65614.

References: (1) Ankinovich, E.A. (1959) New vanadium minerals – satpaevite and al'vanite [alvanite]. Zap. Vses. Mineral. Obshch., 88, 157–164 (in Russian). (2) (1959) Amer. Mineral., 44, 1325–1326 (abs. ref. 1). (3) Pertlik, F. and P.J. Dunn (1990) Crystal structure of alvanite, $(Zn, Ni)Al_4(VO_3)_2(OH)_{12}\cdot 2H_2O$, the first example of an unbranched zweier-single chain vanadate in nature. Neues Jahrb. Mineral., Monatsh., 385–392. (4) Dunn, P.J., A.C. Roberts, and F. Pertlik (1990) Alvanite from Kazakhstan, U.S.S.R.: new crystallographic and chemical data. Mineral. Mag., 54, 609–611.