Kazakhstanite $\mathbf{Fe_5^{3+}V_3^{4+}V_{12}^{5+}O_{39}(OH)_9 \cdot 9H_2O}$

Crystal Data: Monoclinic. *Point Group:* $2/m$ or m. Crystals platy, dominated by {001}, in round or oval grains, to 1 mm, in aggregates up to 1.5 cm.

Physical Properties: *Cleavage:* Perfect on {001}. Hardness = ∼2.5 VHN = 62–69 (10 g load). D(meas.) = 3.4–3.6 D(calc.) = 3.52

Optical Properties: Opaque. *Color:* Black. *Streak:* Black, with slight brownish tint. *Luster:* Adamantine, dull in aggregates.
Optical Class: Biaxial.
R: (400) —, (420) —, (440) 16.4, (460) 15.8, (480) 15.0, (500) 14.3, (520) 13.6, (540) 13.1, (560) 12.8, (580) 12.3, (600) 12.1, (620) 12.0, (640) 12.0, (660) 11.9, (680) 11.8, (700) 11.8

Cell Data: *Space Group:* $C2/c$ or Cc. $a = 11.84(1)$ $b = 3.6500(4)$ $c = 21.27(1)$ $\beta = 100(0.1)^\circ$ $Z = 1$

X-ray Powder Pattern: Kara-Tau Mountains, Kazakhstan.
10.51 (10), 3.484 (6), 2.606 (4), 2.915 (3), 2.756 (3), 3.184 (2), 2.095 (2)

Chemistry:

	(1)	(2)
V_2O_5	55.10	55.04
V_2O_4	12.88	12.55
Fe_2O_3	19.88	20.14
CaO	0.09	
K_2O	0.14	
H_2O^+	12.50	12.27
P_2O_5	0.17	
Total	100.76	100.00

(1) Kara-Tau Mountains, Kazakhstan; Fe_2O_3 given as Fe_4O_3, stated to correspond to $Fe_5^{3+}V_3^{4+}V_{12}^{5+}O_{39}(OH)_9 \cdot 8.55H_2O$. (2) $Fe_5V_3^{4+}V_{12}^{5+}O_{39}(OH)_9 \cdot 9H_2O$.

Occurrence: In thin veins or cementing breccia in the weathering zone of vanadiferous black shales (Kara-Tau Mountains, Kazakhstan); in a hydrothermal gold deposit (Gold Quarry mine, Nevada, USA).

Association: Bokite (Kara-Tau Mountains, Kazakhstan); fervanite, schubnelite, hewettite, tyuyamunite, cacoxenite, variscite, fluellite (Gold Quarry mine, Nevada, USA).

Distribution: From the Kurumsak, Balasauskandyk, and Ran vanadium deposits, northwestern Kara-Tau Mountains, and at Mt. Dzhebagly, Talass Alatau Range, southern Kazakhstan. In the Gold Quarry mine, near Carlin, Maggie Creek district, Eureka Co., Nevada, USA.

Name: For its occurrences in Kazakhstan.

Type Material: A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, p457/1.

References: (1) Ankinovich, E.A., G.K. Bekenova, and N.I. Podlipaeva (1989) A new hydrous ferrovanadian mineral kazakhstanite $Fe_5^{3+}V_3^{4+}V_{12}^{5+}O_{39}(OH)_9 \cdot 8.55H_2O$ from a carbonaceous-siliceous formation in NW Karatau (southern Kazakhstan). Zap. Vses. Mineral. Obshch., 118(5), 95–100 (in Russian). (2) (1991) Amer. Mineral., 76, 667 (abs. ref. 1). (3) (1992) Amer. Mineral., 77, 213 (erratum). (4) Jensen, M.C., J.C. Rota, and E.E. Foord (1995) The Gold Quarry mine, Carlin-Trend, Eureka, Nevada. Mineral. Record, 26, 449–469, esp. 459.