Tivanite $V^{3+}TiO_3(OH)$

Crystal Data: Monoclinic, pseudohexagonal. *Point Group:* $2/m$. Irregular crystallites, to 30 μm, in complexly twinned aggregates. *Twinning:* Very common to universal, as seen in section; by four complex twin laws determined from structural analysis, enhancing the pseudohexagonality.

Physical Properties: Hardness = n.d. VHN = 650(100) (50 g load). D(meas.) = n.d. D(calc.) = 4.17

Optical Properties: Opaque. *Color:* Black; gray in reflected light. *Streak:* Black. *Luster:* Submetallic.
Optical Class: Biaxial. *Anisotropism:* Weak to moderate; in shades of gray.
R: (470) 16.8, (546) 17.4, (589) 17.7

Cell Data: *Space Group:* $P2_1/c$. $a = 7.494(5)$ $b = 4.552(4)$ $c = 10.005(8)$ $\beta = 129.79(2)^\circ$ Z = [4]

X-ray Powder Pattern: Calculated from the crystal structure of natural material.
3.880 (100), 2.795 (94), 2.636 (69), 1.693 (31), 1.683 (30), 3.917 (25), 2.535 (24)

Chemistry:

	(1)	(2)
TiO_2	41.03	48.76
Fe_2O_3	1.57	
V_2O_3	48.27	45.74
H_2O	[5.97]	5.50
Total	[96.84]	100.00

(1) Lake View mine, Western Australia; by electron microprobe, average of three analyses, total V as V_2O_3, total Fe as Fe_2O_3, H_2O calculated from stoichiometry; corresponding to $(V^{3+}_{1.09}Fe^{3+}_{0.04})_{\Sigma=1.13}Ti_{0.87}O_{2.87}(OH)_{1.13}$. (2) $V^{3+}TiO_3(OH)$.

Occurrence: As a grain in micaceous V–Au-rich stringers in a hydrothermal gold deposit.

Association: Quartz, nolanite, vanadium-rich muscovite.

Distribution: From the Lake View mine, Kalgoorlie, Western Australia.

Name: For TItanium and VANadium in the composition.

Type Material: C.S.I.R.O, Perth, Australia, 5996, gone walkabout.

References: (1) Grey, I.E. and E.H. Nickel (1981) Tivanite, a new oxyhydroxide mineral from Western Australia, and its structural relationship to rutile and diaspore. Amer. Mineral., 66, 866–871.