Wakefieldite-(Ce) $(Ce, La, Nd, Pb)VO_4$

Crystal Data: Tetragonal. *Point Group:* $4/m\ 2/m\ 2/m$. Crystals, to 4 mm, pyramidal {101}, or prismatic, with {100}, {001}, {110}, {111}.

Physical Properties: *Cleavage:* On {100}, good. *Tenacity:* Very brittle. Hardness = 4.5–5 VHN = 440 (100 g load). D(meas.) = 4.74(7) D(calc.) = [5.42]

Optical Properties: Translucent to opaque. *Color:* Dark red to coal-black, pale yellow to bluish gray; honey-yellow in thin section, may exhibit strong red internal reflections.
Streak: Rust-brown.
Optical Class: Uniaxial (+), may be biaxial (–). *Pleochroism:* Strong; O = light red, pale brown; E = very dark red, hazel-brown. $\omega = 1.990(5)$ $\epsilon = 2.160(5)$

Cell Data: *Space Group:* $I4_1/amd$. $a = 7.33$–7.35 $c = 6.45$–6.56 $Z = 4$

X-ray Powder Pattern: Kusu deposit, Congo.
3.678 (100), 2.766 (90), 1.891 (70), 4.89 (50), 2.594 (40), 1.638 (40), 2.291 (30)

Chemistry:

	(1)	(2)
V_2O_5	31.80	33.18
La_2O_3		15.53
Ce_2O_3	35.80	38.07
Nd_2O_3		7.43
Sm_2O_3		0.62
PbO_2	[18.27]	
PbO	[17.05]	
Total	[102.92]	94.83

(1) Kusu deposit, Congo; by electron microprobe, average of two analyses with Pb divided equally between Pb^{2+} and Pb^{4+}; then corresponds to $(Ce^{3+}_{0.60}Pb^{2+}_{0.22}Pb^{4+}_{0.22})_{\Sigma=1.04}V_{0.98}O_4$. (2) Yellow Lake, Canada; by X-ray fluorescence, total deficient as not all RE elements determined; corresponds to $(Ce_{0.63}La_{0.26}Nd_{0.12}Sm_{0.01})_{\Sigma=1.02}V_{0.99}O_4$.

Occurrence: In silicified limestone (Kusu deposit, Congo); in vesicles with zeolites (Yellow Lake, Canada).

Association: Mottramite (Kusu deposit, Congo); brewsterite, heulandite, analcime, mesolite, thomsonite, calcite, fluorite (Yellow Lake, Canada).

Distribution: In the Kusu vanadium deposit, 85 km south of Kinshasa, Bas-Congo Province, Congo (Bas-Zaire Province, Zaire). At Tifernine, Morocco. On the north side of Yellow Lake, British Columbia, Canada.

Name: Originally described as "kusuite"; the name later changed to reflect its identity as the *cerium* analog of *wakefieldite*-(Y).

Type Material: Royal Museum of Central Africa, Tervuren, Belgium, RMG5895; Natural History Museum, Paris, France, 178.119; National Museum of Natural History, Washington, D.C., USA, 136817.

References: (1) Deliens, M. and P. Piret (1977) La kusuïte $(Ce^{3+}, Pb^{2+}, Pb^{4+})VO_4$, nouveau minéral. Bull. Soc. fr. Minéral., 100, 39–41 (in French with English abs.). (2) (1977) Amer. Mineral., 62, 1058 (abs. ref. 1). (3) Deliens, M. and P. Piret (1988) La kusuïte devient la wakefieldite-(Ce) plombifère. [kusuite = plumboan wakefieldite-(Ce)] Bull. Minéral., 109, 305 (in French with English abs.). (4) Baudracco-Gritti, C., S. Quartieri, G. Vezzalini, F. Permingeat, F. Pillard, and R. Rinaldi (1987) Une wakefieldite-(Ce) non plombifère: nouvelles données sur l'espèce minérale correspondant à l'orthovanadate de cérium. Bull. Minéral., 110, 657–663 (in French with English abs.). (5) Howard, D.G. (1995) Occurrence of wakefieldite-(Ce) with zeolites at Yellow Lake, British Columbia, Canada. Neues Jahrb. Mineral., Monatsh., 127–132.