Lindsleyite $(Ba,Sr)(Ti,Cr,Fe,Mg,Zr)_{21}O_{38}$

Crystal Data: Hexagonal. *Point Group:* $\overline{3}$ or 3. Grains, to 5 mm, rimmed by and enclosed in other minerals.

Physical Properties: *Fracture:* Conchoidal. Hardness = n.d. VHN = [1378–1714, 1505 average (100 g load)] ("comparable to mathiasite"). D(meas.) = n.d. D(calc.) = 4.63

Optical Properties: Opaque. *Color:* Black; tan in reflected light. *Luster:* Metallic. *Optical Class:* Uniaxial. *Pleochroism:* Weak; buff-white to tan. *Anisotropism:* Weak; pale tan to brown.
R_1–R_2: (400) 19.4–19.8, (420) 19.0–19.2, (440) 18.6–18.9, (460) 18.1–18.4, (480) 17.8–18.1, (500) 17.5–17.8, (520) 17.2–17.5, (540) 17.1–17.3, (560) 16.9–17.1, (580) 16.7–17.0, (600) 16.7–16.9, (620) 16.6–16.9, (640) 16.5–16.8, (660) 16.5–16.9, (680) 16.5–16.9, (700) 16.5–16.9

Cell Data: *Space Group:* $R\overline{3}$ or $R3$. $a = 10.37$ $c = 20.52$ $Z = 3$

X-ray Powder Pattern: South Africa.
2.13 (100), 1.80 (100), 1.59 (100), 1.44 (100), 2.87 (70), 2.83 (70), 1.50 (50)

Chemistry:

	(1)	(2)		(1)	(2)
Nb_2O_5	0.02	2.04	V_2O_3		0.78
Ta_2O_5	0.03		FeO	11.20	8.92
V_2O_5	0.98		MnO	0.19	
SiO_2	0.00	0.17	PbO	0.07	
TiO_2	54.28	53.30	MgO	3.54	3.76
ZrO_2	4.02	4.39	CaO	0.42	0.38
Al_2O_3	0.09	0.27	SrO	1.69	0.93
La_2O_3		1.48	BaO	4.60	5.07
CeO_2		0.11	Na_2O	0.01	
RE_2O_3	2.21		K_2O	0.21	0.29
Cr_2O_3	16.22	17.19	Total	99.78	99.08

(1) De Beers mine, South Africa; by electron microprobe, all Fe as FeO, $RE_2O_3 = La_2O_3$ 0.05%, Ce_2O_3 1.36%, Nd_2O_3 0.01%, Eu_2O_3 0.08%, Tb_2O_3 0.04%, Ho_2O_3 0.03%, Er_2O_3 0.27%, Tm_2O_3 0.19%, Lu_2O_3 0.18%; corresponds to $(Ba_{0.55}Sr_{0.30}RE_{0.25}Ca_{0.14}Pb_{0.11}K_{0.08}Na_{0.01})_{\Sigma=1.44}(Ti_{12.36}Cr_{3.88}Fe_{2.84}Mg_{1.60}Zr_{0.59}V_{0.20}Mn_{0.05}Al_{0.03})_{\Sigma=21.55}O_{38}$. (2) Shandong Province, China; corresponds to $(Ba_{0.58}La_{0.16}Ca_{0.12}K_{0.11}Ce_{0.01})_{\Sigma=0.98}(Ti_{11.8}Cr_{4.00}Fe_{2.19}Mg_{1.65}Zr_{0.63}Nb_{0.27}V_{0.15}Al_{0.09}Si_{0.05})_{\Sigma=20.83}O_{38}$.

Mineral Group: Crichtonite group.

Occurrence: A mantle-derived phase in veinlets in metasomatized kimberlite (South Africa).

Association: Mathiasite, phlogopite, perovskite, chromian diopside, potassian richterite, Nb–Cr rutile, Mg–Cr–Nb ilmenite, chromian spinel (South Africa).

Distribution: From the De Beers and Bultfontein diamond mines, Kimberley, Cape Province, South Africa. At an undisclosed locality [Yimeng Mountain area] in Shandong Province, China.

Name: For Professor Donald Hale Lindsley (1934–), State University of New York, Stony Brook, New York, USA, for his work in high-pressure petrology.

Type Material: South African National Museum, Cape Town, South Africa; The Natural History Museum, London, England; National Museum of Natural History, Washington, D.C., USA.

References: (1) Haggerty, S.E., J.R. Smyth, A.J. Erlank, R.S. Rickard, and R.V. Danchin (1983) Lindsleyite (Ba) and mathiasite (K): two new chromium-titanates in the crichtonite series from the upper mantle. Amer. Mineral., 68, 494–505. (2) Zhang Jianhong, Ma Jianguo, and Li Liangjing (1988) The crystal structures and crystal chemistry of lindsleyite and mathiasite. Dizhi Lunp'ing [Geological Review], 34(2), 132–144 (in Chinese with English abs.).