Mathiasite $(K, Ca, Sr)(Ti, Cr, Fe, Mg)_{21}O_{38}$

Crystal Data: Hexagonal. *Point Group:* $\overline{3}$. Grains, to 5 mm, may rim other minerals.

Physical Properties: *Fracture:* Conchoidal. Hardness = n.d. VHN = 1378–1714, 1505 average (100 g load). D(meas.) = n.d. D(calc.) = 4.39

Optical Properties: Opaque. *Color:* Black; tan in reflected light. *Luster:* Metallic. *Optical Class:* Uniaxial. *Pleochroism:* Weak; dark tan. *Anisotropism:* Moderate; brownish tan to dark brown.
R_1–R_2: (400) 20.1–20.8, (420) 19.5–20.2, (440) 19.0–19.7, (460) 18.5–19.2, (480) 18.1–18.6, (500) 17.7–18.4, (520) 17.4–18.2, (540) 17.2–17.9, (560) 16.9–17.7, (580) 16.8–17.6, (600) 16.6–17.4, (620) 16.5–17.4, (640) 16.5–17.3, (660) 16.5–17.3, (680) 16.4–17.3, (700) 16.4–17.3

Cell Data: *Space Group:* $R\overline{3}$. $a = 10.361$ $c = 20.65$ $Z = 3$

X-ray Powder Pattern: South Africa.
2.14 (100), 1.44 (100), 2.25 (90), 2.99 (80), 2.88 (80), 1.79 (70), 3.39 (60)

Chemistry:	(1)	(2)		(1)	(2)		(1)	(2)
U_3O_8	0.01		Al_2O_3	0.62	0.51	CaO	1.09	0.39
Nb_2O_5	0.15		Cr_2O_3	16.71	17.70	SrO	0.66	0.79
Ta_2O_5	0.08		RE_2O_3	2.01	1.21	BaO	0.96	3.25
SiO_2	0.00		FeO	7.96	8.71	Na_2O	0.09	
TiO_2	59.32	56.86	MnO	0.14		K_2O	1.22	1.30
ZrO_2	5.35	5.22	PbO	0.02		Total	[100.52]	99.99
ThO_2	0.01		MgO	4.12	4.05			

(1) Jagersfontein, Bultfontein, and Kolonkwanen kimberlites, South Africa; by electron microprobe, average of six analyses, total Fe as FeO, original total given as 100.46%; RE_2O_3 = Y_2O_3 0.01%, La_2O_3 0.19%, Ce_2O_3 0.35%, Nd_2O_3 0.07%, Sm_2O_3 0.01%, Eu_2O_3 0.01%, Gd_2O_3 0.01%, Tb_2O_3 0.03%, Dy_2O_3 0.01%, Ho_2O_3 0.04%, Er_2O_3 0.21%, Tm_2O_3 0.39%, Yb_2O_3 0.01%, Lu_2O_3 0.67%; corresponds to $(K_{0.45}Ca_{0.34}RE_{0.18}Sr_{0.11}Ba_{0.11}Na_{0.05})_{\Sigma=1.24}$ $(Ti_{12.82}Cr_{3.89}Fe_{1.91}Mg_{1.76}Zr_{0.75}Al_{0.22}Ta_{0.07}Mn_{0.03}Nb_{0.02})_{\Sigma=21.47}O_{38}$. (2) Shandong Province, China; corresponds to $(K_{0.47}Ba_{0.36}Sr_{0.13}Ca_{0.12}RE_{0.12})_{\Sigma=1.20}(Ti_{12.10}Cr_{3.96}Fe_{2.06}Mg_{1.71}$ $Zr_{0.72}Al_{0.17})_{\Sigma=20.72}O_{38}$.

Mineral Group: Crichtonite group.

Occurrence: A primary mantle-derived phase found in heavy-mineral concentrates from metasomatized kimberlite (South Africa).

Association: Lindsleyite, olivine, diopside, phlogopite, Ce-bearing barite, Nb–Cr rutile, Mg–Cr spinel, ilmenite, perovskite, titanite (South Africa); yimengite (Shandong Province, China).

Distribution: From the Jagersfontein diamond mine, Free State, and the Bultfontein diamond mine and Kolonkwanen kimberlite prospect, Mackenzie's Post district, Cape Province, South Africa. From an undisclosed locality [Yimeng Mountains], Shandong Province, China.

Name: Honors Professor Frances Celia Morna Mathias (1913–), University of Cape Town, Cape Town, South Africa, for her contributions to studies of mantle-derived rocks.

Type Material: 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) Gatehouse, B.M., I.E. Grey, and J.R. Smyth (1983) Structure refinement of mathiasite, $(K_{0.62}Na_{0.14}Ba_{0.14}Sr_{0.10})_{\Sigma=1.0}[Ti_{12.90}Cr_{3.10}$ $Mg_{1.53}Fe_{2.15}Zr_{0.67}Ca_{0.29}(V, Nb, Al)_{0.36}]_{\Sigma=21.0}O_{38}$. Acta Cryst., C39, 421–422. (3) 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.).