Hezuolinite $(Sr,REE)_4Zr(Ti,Fe^{3+},Fe^{2+})_2Ti_2O_8(Si_2O_7)_2$

Crystal Data: Monoclinic. *Point Group*: 2/*m.* As grains to several 100 μm. *Twinning*: Polysynthetic twins were observed.

Physical Properties: *Cleavage*: None. *Fracture*: Conchoidal. *Tenacity*: Brittle. Hardness = 5.5-6 VHN = 683-964 (100 g load). D(meas.) = 4.28 D(calc.) = 4.30

Optical Properties: Translucent. *Color*: Black. *Streak*: Dark brown. *Luster*: Resinous. *Optical Class*: Biaxial (–). $n > 1.8$ $2V = 75°$ *Dispersion*: Strong, $r > v$. *Pleochroism*: Strong, X = pale brown, Y = brown, Z = dark brown.

Cell Data: *Space Group*: $C2/m$. $a = 13.973(3)$ $b = 5.6984(11)$ $c = 11.988(2)$ $\beta = 114.10(1)°$ $Z = 2$

X-ray Powder Pattern: Saima alkaline complex, Fengcheng County, Liaoning Province, China. 2.98 (100), 3.02 (90), 1.96 (90), 2.18 (80), 2.84 (70), 2.72 (50), 2.51 (50)

Chemistry:

	(1)		(1)
SiO_2	21.90	Na_2O	0.35
TiO_2	24.42	ThO_2	0.80
Al_2O_3	0.16	UO_2	0.01
FeO	1.84	La_2O_3	7.12
Fe_2O_3	2.61	Ce_2O_3	8.16
MnO	0.07	Pr_2O_3	0.45
MgO	0.01	Nd_2O_3	1.34
Nb_2O_5	0.28	Sm_2O_3	0.10
ZrO_2	9.18	Eu_2O_3	0.16
HfO_2	0.39	Gd_2O_3	0.06
SrO	20.12	Total	101.99
CaO	2.46		

(1) Saima alkaline complex, Liaoning Province, China; average of 25 electron microprobe analyses, oxidation ratio for iron from Mössbauer spectroscopy; corresponding to $(Sr_{2.15}Ce_{0.55}La_{0.49}Ca_{0.49}Na_{0.12}Nd_{0.09}Pr_{0.03}Th_{0.03}Sm_{0.01}Eu_{0.01})_{\Sigma=3.98}(Zr_{0.82}Fe^{2+}_{0.14}Hf_{0.02}Mn_{0.01})_{\Sigma=1.00}$ $(Ti_{1.38}Fe^{3+}_{0.36}Fe^{2+}_{0.14}Al_{0.04}Nb_{0.02})_{\Sigma=1.94}Ti_2O_8(Si_{2.01}O_7)_2$.

Mineral Group: Chevkinite group.

Occurrence: In a series of alkaline volcanic and intrusive igneous rocks, associated with aegirine nepheline syenite.

Association: Microcline, nepheline, aegirine, biotite, eudialyte, rinkite, titanite.

Distribution: From the Saima alkaline complex, Fengcheng County, Liaoning Province, NE China.

Name: Honors He Zuolin (1900-1967), for his contributions to optical mineralogy and rare-earths mineralogy in China. Hezuolinite corresponds to the previously discredited "saimaite".

Type Material: Museum of the Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China (KDX016).

References: (1) Yang, Z., G. Giester, K. Ding, and E. Tillmanns (2012) Hezuolinite, $(Sr,REE)_4Zr(Ti,Fe^{3+},Fe^{2+})_2Ti_2O_8(Si_2O_7)_2$, a new mineral species of the chevkinite group from Saima alkaline complex, Liaoning Province, NE China. European Journal of Mineralogy, 24(1), 189-196. (2) (2014) Amer. Mineral., 99, 2153-2154 (abs. ref. 1).