Chirvinskyite $(Na, Ca)_{13}(Fe, Mn, \square)_2Ti_2(Zr, Ti)_3(Si_2O_7)_4(OH, O, F)_{12}$

Crystal Data: Triclinic. *Point Group*: $\bar{1}$. Forms sheaf-like radiated aggregates of split fibrous crystals to 6 mm.

Physical Properties: *Cleavage*: None. *Tenacity*: Brittle. *Fracture*: Fibrous. Hardness = 5
D(meas.) = 3.07(2) D(calc.) = 3.41 Nonfluorescent.

Optical Properties: Transparent to translucent. *Color*: Pale cream, colorless in thin section.
Streak: White. *Luster*: Silky.
Optical Class: Biaxial (-). $\alpha = 1.670(2)$ $\beta = 1.690(2)$ $\gamma = 1.705(2)$ 2V(calc.) = 80.9°
Orientation: $Z = b$, $X \wedge c = 14°$. No pleochroism.

Cell Data: *Space Group*: $P\bar{1}$. $a = 7.0477(5)$ $b = 9.8725(5)$ $c = 12.2204(9)$ $\alpha = 77.995(5)°$ $\beta = 82.057(6)°$ $\gamma = 89.988(5)°$ $Z = 1$

X-Ray Diffraction Pattern: Mt. Takhtarvumchorr, Khibiny massif, Kola Peninsula, Russia.
2.796 (100), 2.886 (57), 7.00 (34), 3.416 (33), 1.7407 (25), 3.956 (23), 5.907 (17)

Chemistry:

	(1)
MgO	0.13
SiO_2	28.22
K_2O	0.03
CaO	10.80
TiO_2	11.46
MnO	2.87
FeO	3.03
ZrO_2	16.43
Nb_2O_5	1.46
F	3.32
H_2O	[3.14]
-O = F	1.40
Total	97.34

(1) Mt. Takhtarvumchorr, Khibiny alkaline massif, Kola Peninsula, Russia; average electron microprobe analysis supplemented by Raman spectroscopy, H_2O calculated and confirmed by Penfield method; corresponding to $(Na_{9.81}Ca_{3.28}K_{0.01})_{\Sigma=13.10}(Fe_{0.72}Mn_{0.69}\square_{0.54}Mg_{0.05})_{\Sigma=2.00}(Ti_{1.81}Nb_{0.19})_{\Sigma=2.00}(Zr_{2.27}Ti_{0.63})_{\Sigma=2.90}(Si_2O_7)_4[(OH)_{5.94}O_{3.09}F_{2.97}]_{\Sigma=12.00}$.

Occurrence: In albitized alkaline pegmatites in a foyaite.

Association: Natrolite, albite, fluorapatite, aegirine, parakeldyshite, lorenzenite, fluorcalciopyrochlore.

Distribution: From Mt. Takhtarvumchorr, Khibiny alkaline massif, Kola Peninsula, Russia.

Name: Honors Petr Nikolaevich *Chirvinsky* (1880-1955), Russian geologist and petrographer, head of the Petrography Department, Perm' State University (1943-1953), for his contributions to mineralogy and petrology, including studies of the Khibiny alkaline massif.

Type Material: Mineralogical Museum, St. Petersburg State University (19657) and the Geological and Mineralogical Museum, Geological Institute, Kola Science Centre, Apatity, Russia (GIM 7609).

References: (1) Yakovenchuk, V.N., Y.A. Pakhomovsky, T.L. Panikorovskii, A.A. Zolotarev, J.A. Mikhailova, N.V. Bocharov, S.V. Krivovichev, and G.Yu. Ivanyuk (2019) Chirvinskyite, $(Na,Ca)_{13}(Fe,Mn,\square)_2(Ti,Nb)_2(Zr,Ti)_3(Si_2O_7)_4(OH,O,F)_{12}$, a new mineral with a modular wallpaper structure, from the Khibiny Alkaline Massif (Kola Peninsula, Russia). Minerals, 9, 219, 1-15.