Sveinbergeite $Ca(Fe_6^{2+}Fe^{3+})Ti_2(Si_4O_{12})_2O_2(OH)_5(H_2O)_4$

Crystal Data: Triclinic. *Point Group*: $\bar{1}$. Crystals lamellar, to 10 mm, in rosette-like divergent groups and spherical aggregates, also as scaly, radiating masses.

Physical Properties: *Cleavage*: Perfect on {001}. *Fracture*: Uneven. *Tenacity*: Flexible. Hardness = 3 D(meas.) = n.d. D(calc.) = 3.152

Optical Properties: Transparent. *Color*: Dark green. *Streak*: Pale green.
Luster: Vitreous to pearly.
Optical Class: Biaxial (+). α = 1.745(2) β = 1.746(2) γ = 1.753(2) 2V(meas.) = 20(3)° 2V(calc.) = 41.5° *Orientation*: $X \wedge (001)$, $Y \wedge b = 12°$, $Z = a$. *Pleochroism*: Medium, Z = deep green, $X = Y$ = brownish green. *Absorption*: $Z > X \sim Y$.

Cell Data: *Space Group: P*$\bar{1}$. a = 5.329(4) b = 11.803(8) c = 11.822(8) α = 101.140(8)° β = 98.224(8)° γ = 102.442(8)° Z = 1

X-ray Powder Pattern: Buer syenite pegmatite, Larvik plutonic complex, Oslo Region, Norway. 11.395 (100), 2.880 (38), 2.640 (31), 1.643 (24), 2.492 (20), 1.616 (15), 1.573 (14)

Chemistry:

	(1)	(2)		(1)	(2)
Nb_2O_5	0.55		CaO	3.87	4.23
TiO_2	10.76	12.06	MgO	0.52	
ZrO_2	0.48		K_2O	0.49	
SiO_2	34.41	36.29	Na_2O	0.27	
Al_2O_3	0.34		F	0.24	
Fe_2O_3	5.57	6.03	H_2O	[8.05]	8.84
FeO	29.39	32.54	-O=F	0.10	.
MnO	1.27		Total	96.11	100.00

(1) Buer syenite pegmatite, Larvik plutonic complex, Oslo Region, Norway; electron microprobe analysis, Fe^{2+}/Fe^{3+} ratio calculated from structure refinement and Mössbauer spectroscopic data, H_2O calculated from structure analysis and OH confirmed by IR, corresponding to $(Ca_{0.95}Na_{0.12}K_{0.14})_{\Sigma=1.21}Fe^{2+}_{5.65}Fe^{3+}_{0.93}Mn_{0.25}Mg_{0.18})_{\Sigma=7.01}(Ti_{1.86}Nb_{0.06}Zr_{0.05}Fe^{3+}_{0.03})_{\Sigma=2}(Si_{7.91}Al_{0.09})_{\Sigma=8}O_{34.61}H_{12.34}F_{0.17}$. (2) $Ca(Fe_6^{2+}Fe^{3+})Ti_2(Si_4O_{12})_2O_2(OH)_5(H_2O)_4$.

Mineral Group: Astrophyllite group.

Occurrence: A late forming mineral in cavities in syenite pegmatite in an alkaline plutonic complex.

Association: Microcline, magnesiokatophorite, aenigmatite, aegirine, albite, calcite, fluorapatite, molybdenite, galena, a hochelagaite-like mineral.

Distribution: Buer syenite pegmatite, Larvik plutonic complex, Vesterøya peninsula, Sandefjord, Oslo Region, Norway.

Name: Honors Svein Arne Berge (b. 1949), the Norwegian amateur mineralogist who observed and collected the first specimens.

Type Material: A.E. Fersman Mineralogical Museum, Academy of Science, Moscow, Russia (3966) and the Natural History Museum, Section of Geology, University of Oslo, Norway (42259 and 42260).

References: (1) Khomyakov, A.P., F. Cámara, E. Sokolova, Y. Abdu, and F.C. Hawthorne (2011) Sveinbergeite, $Ca(Fe_6^{2+}Fe^{3+})Ti_2(Si_4O_{12})_2O_2(OH)_5(H_2O)_4$, a new astrophyllite-group mineral from the Larvik Plutonic Complex, Oslo Region, Norway: Description and crystal structure. Mineralogical Magazine, 75, 2687-2702. (2) (2014) Amer. Mineral., 99, 873-874 (abs. ref. 1).