Sveinbergeite \( \text{Ca}(\text{Fe}^{2+}\text{Fe}^{3+})\text{Ti}_2(\text{Si}_4\text{O}_{12})_2\text{O}_2(\text{OH})_5(\text{H}_2\text{O})_4 \)

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

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


**Cell Data:**  \textit{Space Group}: \( \overline{P1} \).  \( a = 5.329(4) \)  \( b = 11.803(8) \)  \( c = 11.822(8) \)  \( \alpha = 101.140(8)^\circ \)  \( \beta = 98.224(8)^\circ \)  \( \gamma = 102.442(8)^\circ \)  \( Z = 1 \)

**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:**

\[
\begin{array}{ccc}
\text{Nb}_2\text{O}_5 & 0.55 & \text{CaO} & 3.87 & 4.23 \\
\text{TiO}_2 & 10.76 & 12.06 & \text{MgO} & 0.52 \\
\text{ZrO}_2 & 0.48 & \text{K}_2\text{O} & 0.49 \\
\text{SiO}_2 & 34.41 & 36.29 & \text{Na}_2\text{O} & 0.27 \\
\text{Al}_2\text{O}_3 & 0.34 & \text{F} & 0.24 \\
\text{Fe}_2\text{O}_3 & 5.57 & 6.03 & \text{H}_2\text{O} & [8.05] 8.84 \\
\text{FeO} & 29.39 & 32.54 & \text{O} = \text{F} & 0.10 \\
\text{MnO} & 1.27 & & & \\
\hline
\text{Total} & & & & 96.11 100.00
\end{array}
\]

(1) Buer syenite pegmatite, Larvik plutonic complex, Oslo Region, Norway; electron microprobe analysis, \( \text{Fe}^{2+}/\text{Fe}^{3+} \) ratio calculated from structure refinement and Mössbauer spectroscopic data, \( \text{H}_2\text{O} \) calculated from structure analysis and OH confirmed by IR, corresponding to \((\text{Ca}_{0.95}\text{Nb}_{0.15}\text{K}_{0.14}\text{H}_{2.12}\text{Fe}^{2+}_{5.65}\text{Fe}^{3+}_{0.35}\text{Mn}_{0.25}\text{Mg}_{0.18}\text{Ti}_{0.71}\text{Fe}^{3+}_{0.03}\text{Zr}_{0.69}\text{Si}_{7.91}\text{Al}_{0.09})_{5+} \text{O}_{14+}\text{H}_{12.34}\text{F}_{0.17} \).  (2) \( \text{Ca}(\text{Fe}^{2+}\text{Fe}^{3+})\text{Ti}_2(\text{Si}_4\text{O}_{12})_2\text{O}_2(\text{OH})_5(\text{H}_2\text{O})_4 \).

**Mineral Group:** Astrophylite 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 hochenlaugite-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. Cámera, E. Sokolova, Y. Abdu, and F.C. Hawthorne (2011) Sveinbergeite, \( \text{Ca}(\text{Fe}^{2+}\text{Fe}^{3+})\text{Ti}_2(\text{Si}_4\text{O}_{12})_2\text{O}_2(\text{OH})_5(\text{H}_2\text{O})_4 \), 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).