Kentbrooksite from the Kangerdlugssuaq intrusion, East Greenland, a new Mn-REE-Nb-F end-member in a series within the eudialyte group: Description and crystal structure

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Abstract: Kentbrooksite, ideally (Na,REE)IS(Ca,REE)6Mn3Zr3NbSi2S074F2 . 2H2O, is a new mineral from the Kangerdlugssuaq intrusion, East Greenland. The mineral occurs in alkaline pegmatitic bodies cutting pulaskite rocks and is found as anhedral to subhedral aggregates up to 2 cm. It is transparent, yellow-brown with white streak and vitreous luster. Hardness 5–6, brittle, uneven fracture and no cleavage. It is pyroelectric. The mineral is uniaxial negative, \( \omega = 1.628(2) \) and \( \varepsilon = 1.623(2) \), nonpleochroic. \( D_{\text{meas}} = 3.10(4) \) g/cm\(^3\), \( D_{\text{calc}} = 3.08 \) g/cm\(^3\).

The mineral is trigonal, space group \( R3m \), \( a = 14.1686(2) \) Å, \( c = 30.0847(4) \) Å, \( Z = 3 \). The strongest reflections in the X-ray powder pattern are \( d(\AA), \text{Int}, (hkl) \): 2.839, 100, (404); 2.961, 91, (315); 11.385, 43, (101); 7.088, 41, (110); 3.380, 37, (131); 4.295, 34, (205); and 5.682, 30, (202). The empirical formula, based on 3.77 (Zr + Hf + Nb + Ti) pfu, is

\[
\begin{align*}
\text{Na}_{14.93} & \text{REE}_{0.44} \text{Y}_{0.42} \text{K}_{0.30} \text{Sr}_{0.15} \text{Ni}_{1.78} \text{REE}_{0.62} \text{Na}_{0.33} \text{Ni}_{0.06} \text{Mn}_{1.90} \text{FeO}_{0.72} \text{Al}_{0.13} \text{Mg}_{0.05} \text{Si}_{2.80} \\
\text{Nb}_{0.55} \text{Zr}_{0.12} & \text{Ti}_{0.10} \text{Zr}_{0.77} \text{Si}_{0.60} \text{H}_{0.06} \text{Mn}_{1.13} \text{Si}_{2.53} \text{Si}_{0.027} \text{O}_{2.02} \text{F}_{1.51} \text{Cl}_{0.27} \text{OH}_{0.22} \text{Si}_{2} \cdot 2.3 \text{H}_2\text{O}.
\end{align*}
\]

IR spectrum is given.

The structure has been refined from single-crystal X-ray diffraction data to \( R_I = 4.1 \)%.

Kentbrooksite belongs to the eudialyte group and has the framework characteristic for this group, consisting of three-membered and nine-membered rings of SiO\(_4\) tetrahedra cross-linked by Zr and Mn in octahedral coordination. Most important structural differences from e.g. eudialyte from the type locality (Ilímaussaq) are: \( ^{15}\)Mn substitution for \( ^{14}\)Fe in \( M_2 \), \( ^{16}\)Nb (M3) substitution for \( ^{30}\)Si (M4), a high content of REE and F substitution for Cl. Kentbrooksite represents the ENb,REE,Mn,F end-member of a series within the eudialyte group.

Key-words: kentbrooksite, eudialyte, new mineral species, end-member, crystal structure, Kangerdlugssuaq, East Greenland.

Introduction

During a study of the chemical variation in eudialyte, a Na-rich zirconosilicate generally with significant amounts of Ca and Fe, Johnsen & Gault (1997) discovered that among some 60 analyses a few were characterized by very high contents of Mn and rare-earth elements (REE), largely at the expense of Fe and Ca. The highest content of Mn (~8 wt% MnO) was found in a sample from Amstrup Fjord, Kangerdlugssuaq intrusion in East Greenland, while the highest content of REE hitherto reported in an eudialyte (9.78 wt% REE\(_2\)O\(_3\), Y\(_2\)O\(_3\) not included) was found in a sample from Mt. St-Hilaire, Quebec, Canada. In both samples the sum of Mn and REE pfu were distinctly higher than the sum of Ca and Fe pfu. With the purpose of exploring the crystal-chem-