

Townendite, Na₈ZrSi₆O₁₈, a new uranium-bearing lovozerite group mineral from the Ilímaussaq alkaline complex, Southern Greenland

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ABSTRACT

Townendite, a new U-bearing mineral belonging to the trigonal lovozerite group has been found in the lujavrite layers of nepheline syenites in the Ilímaussaq alkaline complex in Southern Greenland. Its composition from electron microprobe analysis is Na_{6.08}Ca_{0.16}Mn_{0.17}Fe_{0.13}Zr_{0.67}Y_{0.13}Sn_{0.04}U_{0.02}Ti_{0.01}Si₆O_{16.35}(OH)_{1.65}. Townendite has rhombohedral symmetry, $R\bar{3}m$, with cell parameters (hexagonal setting) $a = 10.345(2)$ Å, $c = 13.103(2)$ Å. The structure has been refined using single-crystal X-ray data to $R_1 = 0.056$ for 532 reflections with $F > 4\sigma(F)$. Lovozerite group minerals are cyclosilicates in which Si₆(O,OH)₁₈ rings of tetrahedra share corners with isolated MO₆ octahedra (M = Zr, Ti, Ca) to form a 3D framework, with large cations, mainly Na⁺, located in cavities in the framework. Townendite differs from other compositionally related lovozerite group minerals in having a high occupancy (92%) of another set of octahedrally coordinated sites that share faces with the MO₆ octahedra, giving linear face-shared trimers parallel to [001]. These sites are occupied predominantly by Na⁺. Full occupancy of all sites corresponds to the ideal composition Na₈ZrSi₆O₁₈. Townendite is a significant contributor, along with steenstrupine-(Ce), to U resources in the Ilímaussaq alkaline complex.

Keywords: New lovozerite group mineral, new U-bearing mineral, Ilímaussaq alkaline complex, new sodium zirconium silicate