

Hydroxymcglassonite-(K), $\text{KSr}_4\text{Si}_8\text{O}_{20}(\text{OH})\cdot 8\text{H}_2\text{O}$, the first Sr-bearing member of the apophyllite group, from the Wessels mine, Kalahari Manganese Field, South Africa

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ABSTRACT

A new mineral species, hydroxymcglassonite-(K), ideally $\text{KSr}_4\text{Si}_8\text{O}_{20}(\text{OH})\cdot 8\text{H}_2\text{O}$, has been found in the Wessels mine, Kalahari Manganese Field, Northern Cape Province, South Africa. It is granular (<0.05 mm), associated with meieranite, sugilite, aegirine, pectolite, and yuzuxiangite. The mineral is colorless, transparent with a white streak and a vitreous luster. It is brittle and has a Mohs hardness of 4.5–5.0; cleavage is perfect on {001} and no parting or twinning was observed. The measured and calculated densities are 2.60(3) and 2.614 g/cm³, respectively. Optically, hydroxymcglassonite-(K) is uniaxial (+), with $\omega = 1.555(5)$, $\epsilon = 1.567(5)$ (white light), and absorption $O > E$. Hydroxymcglassonite-(K) is insoluble in water or hydrochloric acid. An electron microprobe analysis yielded an empirical formula (based on 13 non-H cations pfu) $\text{K}_{1.01}(\text{Sr}_{2.99}\text{Ca}_{1.03})_{\Sigma 4.02}\text{Si}_{7.99}\text{O}_{20}(\text{OH})\cdot 8\text{H}_2\text{O}$, which can be simplified to $\text{K}(\text{Sr,Ca})_4\text{Si}_8\text{O}_{20}(\text{OH})\cdot 8\text{H}_2\text{O}$.

Hydroxymcglassonite-(K) is tetragonal with space group $P4/mnc$ and unit-cell parameters $a = 9.0792(2)$, $c = 16.1551(9)$ Å, $V = 1331.70(9)$ Å³, and $Z = 2$. It is isostructural with hydroxyapophyllite-(K), $\text{KCa}_4\text{Si}_8\text{O}_{20}(\text{OH})\cdot 8\text{H}_2\text{O}$, with Sr substituting for Ca. The crystal structure of hydroxymcglassonite-(K) is characterized by SiO_4 tetrahedra sharing corners to form $(\text{Si}_8\text{O}_{20})^{8-}$ sheets parallel to (001), which are connected by the K and B ($= \text{Sr} + \text{Ca}$) cations, as well as hydrogen bonding. The K cation is coordinated by eight H_2O groups, and the average K–O distance of 2.941(3) Å is shorter than that of 2.950(3)–2.975(3) Å in hydroxyapophyllite-(K) or fluorapophyllite-(K). The B cation is sevenfold-coordinated ($4\text{O} + 2\text{H}_2\text{O} + \text{OH}$), and the average B –O distance of 2.522(3) Å is noticeably longer than that of 2.422–2.435 Å in hydroxyapophyllite-(K) or fluorapophyllite-(K). The Raman spectra of hydroxymcglassonite-(K) and hydroxyapophyllite-(K) are very comparable, especially in the O–H stretching region. The discovery of hydroxymcglassonite-(K), the first Sr-bearing mineral of the apophyllite group, implies that more Sr-bearing members of the group may be found in nature or synthesized in laboratories, but the possibility for an incomplete solid solution between hydroxyapophyllite-(K) and hydroxymcglassonite-(K), due to the size difference between Sr^{2+} and Ca^{2+} , cannot be ruled out.

Keywords: Hydroxymcglassonite-(K), apophyllite, new mineral, crystal structure, X-ray diffraction, Raman spectra