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Polysomatism in högbomite: The crystal structures of 10*T*, 12*H*, 14*T*, and 24*R* polysomes

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ABSTRACT

Högbomite is a closest-packed polysomatic mineral composed of spinel, $T_2M_4O_8$, and nolanite-like, $TM_4O_7(OH)$, modules where T stands for tetrahedrally and M for octahedrally coordinated cations. The modules are stacked in an ordered fashion in various ratios. Single-crystal X-ray diffraction for a 24*R* and a 10*T* polysome and structure modeling for a 12*H* and 14*T* polysome have been applied to characterize different stacking variants.

Högbomite from a spinel-phlogopite schist at Corundum Creek (South Australia) with composition $Mg_{3.8}Fe_{3.2}Zn_{1.6}Ti_{1.0}Al_{18.3}O_{38}(OH)_2$ is a 10*T* polysome with $a = 5.723(1)$, $c = 23.026(4)$ Å, space group $P\bar{3}m1$, $Z = 1$. This polysome with the general formula $T_8M_{20}O_{38}(OH)_2$ is composed of an alternation of spinel (*S*) and nolanite-like (*N*) blocks stacked in the sequence *NSSNS*.

Högbomite from a Fe-Ti deposit at Liganga (Tanzania) with composition $Mg_{13.5}Fe_{5.6}(Zn,Mn,Ni)_{0.2}Ti_{4.7}Al_{41.7}(Cr,Ga)_{0.2}O_{90}(OH)_6$ is a 24*R* polysome with $a = 5.7145(7)$, $c = 55.056(5)$ Å, space group $R\bar{3}m$, $Z = 1$. The structure with the general formula $T_{18}M_{48}O_{90}(OH)_6$ is composed of a periodic alternation of two *S* and two *N* blocks.

The crystal structures of högbomite-12*H*, $T_{10}M_{24}O_{46}(OH)_2$, $a = 5.7$, $c = 27.6$ Å, space group $P6_3mc$, $Z = 1$, and högbomite-14*T*, $T_{12}M_{28}O_{54}(OH)_2$, $a = 5.7$, $c = 32.2$ Å, space group $P\bar{3}m1$, $Z = 1$, were modeled from the stacking principles of the known 6*T*, 8*H*, 10*T*, and 16*H* polysomes. The 12*H* and the 14*T* polysomes have stacking sequences *NSSNSS* and *NSSSNSS*, respectively.