

Crystal chemical variations in Li- and Fe-rich micas from Pikes Peak batholith (central Colorado)

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ABSTRACT

The crystal structure and M-site populations of a series of micas-1M from miarolitic pegmatites that formed within host granitic rocks of the Precambrian, anorogenic Pikes Peak batholith, central Colorado, were determined by single-crystal X-ray diffraction data. Crystals fall in the polyolithionite-siderophyllite-annite field, being $0 \leq \text{Li} \leq 2.82$, $0.90 \leq \text{Fe}_{\text{total}} \leq 5.00$, $0.26 \leq {}^{6}\text{Al} \leq 2.23$ apfu. Ordering of trivalent cations (mainly Al^{3+}) is revealed in a cis-octahedral site (M2 or M3), which leads to a lowering of the layer symmetry from $C12/m(1)$ (siderophyllite and annite crystals) to $C12(1)$ diperiodic group (lithian siderophyllite and ferroan polyolithionite crystals). On the basis of mean bond length, the ordering scheme of octahedral cations is mostly meso-octahedral, whereas the mean electron count at each M site suggests both meso- and hetero-octahedral ordering, the calculated mean atomic numbers being $M1 = M3 \neq M2$, $M2 = M3 \neq M1$ and $M1 \neq M2 \neq M3$. As the siderophyllite content increases, so do the a , b , and c unit-cell parameters, as well as the refractive indices, primarily n_{β} . The tetrahedral rotation angle, α , is generally small ($1.51 \leq \alpha \leq 5.04^\circ$) and roughly increases with polyolithionite content, whereas the basal oxygen out-of-plane tilting, Δz , is sensitive both to octahedral composition and degree of order ($0.0 \leq \Delta z \leq 0.009 \text{ \AA}$ for siderophyllite and annite, $0.058 \leq \Delta z \leq 0.144 \text{ \AA}$ for lithian siderophyllite and ferroan polyolithionite crystals).