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Manganoan kinoshitalite in Mn-rich marble and skarn from Virginia

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ABSTRACT

A new locality for the Ba-rich trioctahedral mica, kinoshitalite [$Ba(Mg,Mn,Fe,Al)_3Si_{1.9\text{-}2}Al_{2.2}O_{10}(OH,F)_2$], has been found in a metamorphosed manganoan marble from Pittsylvania County, Virginia. Metamorphic grade is middle amphibolite facies, with documented *P* and *T* of 400 MPa and 575 °C. The locality is along strike not far from the well known Bald Knob, North Carolina, Mn-mineral locality, and appears to represent a silica-poorer analog of Bald Knob. The kinoshitalite occurs in a single layered hand sample containing both skarn and marble layers, and it shows significant compositional contrasts between the two lithologies. Kinoshitalite is scarce and fine-grained in manganoan marble and coexists with kutnahorite, manganoan calcite, fluorian alleghanyite, fluorian sonolite, aluminous jacobsite, and alabandite. Kinoshitalite is both more abundant and coarser-grained in skarn where it coexists with kutnahorite, tephroite, fluorian manganhumite, spessartine, jacobsite, and manganoan magnetite. A-sites in kinoshitalite in skarn are about 3/4 occupied by Ba (with the remainder mostly K), whereas in marble, Ba occupancy of A-sites exceeds 90% and most of the remainder is Ca. X_{Mg} in octahedral sites is >0.6 and is higher in marble than in skarn, whereas X_{Mn} is significant (>0.2) and is higher in skarn than in marble. The ^{VI}Al is significantly higher in skarn kinoshitalite, as is total Tschermak content. The total Tschermak content of these barian micas ($^{VI}Al + Ti + Fe^{3+}$) is typical of all previously reported kinoshitalites and is significantly lower than that of clintonite and biotite. The X_F of kinoshitalite in marble is significantly higher than that in skarn.

The petrogenesis of kinoshitalite at the Hutter Mine locality is unclear due to the lack of context for the single mine-dump sample in which the mineral was found and the absence of textural evidence for reactions. However, the two likeliest source minerals for Ba that have been found in the deposit are barite and $BaCa(CO_3)_2$ (probably barytocalcite). One hypothetical reaction to produce kinoshitalite involves decarbonation, in which $BaCa(CO_3)_2$, rhodochrosite, Mn-garnet, and aqueous fluid react to form kinoshitalite, tephroite (or an Mn-humite), calcite, and CO_2. A second potential reaction to form kinoshitalite involves barite, Mn-garnet, tephroite, and aqueous fluid as reactants, and kinoshitalite, alabandite, jacobsite, SiO_2, and O_2 as products.