

Single-crystal X-ray studies of trioctahedral micas coexisting with dioctahedral micas in metamorphic sequences from western Maine

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ABSTRACT

A crystal-chemical study of thirteen biotite (twelve of $1M$ polytype and one of $2M_1$ polytype) and four muscovite samples was made. The biotite coexists with the muscovite. Samples are from metamorphic terranes and from granitic and granodioritic bodies occurring in three areas of western Maine. The metamorphic mineral zones identified by mineral compatibilities are, in order of increasing metamorphic grade: the Lower Sillimanite Zone (LSZ), the Upper Sillimanite Zone (USZ), and the K-feldspar + Sillimanite Zone (K + SZ).

The muscovite compositions cluster near ideal muscovite and display a small celadonite substitution and a small, but variable, paragonite substitution. The biotite composition has values of $^{VI}Mg^{2+}/^{VI}(Mg^{2+} + Fe^{2+})$ ranging from 0.26 to 0.54 and significant octahedral Al content ($0.48 \leq ^{VI}Al \leq 0.72$ apfu in metamorphic biotite samples, $0.51 \leq ^{VI}Al \leq 0.67$ in those from granites).

In trioctahedral micas from western Maine and especially in those with graphite, there are a greater number of interlayer vacancies than in common micas. Interlayer vacancies have an increase in interlayer cation-basal oxygen atom distances and a decrease in tetrahedral flattening angle τ , thus suggesting a reduced interlayer charge. With a few exceptions, tetrahedral rotation angle α is related to crystallization temperature. In particular, α decreases with a temperature increase, and α is also related to octahedral chemical substitutions. Results tentatively suggest, for micas from metamorphic environments, a direct influence of genetic parameters (T and f_{O_2}) on mica crystal structure, and not just chemical composition.

Keywords: Biotite, muscovite, western Maine, crystal chemistry, crystal structure