

## **Crystal chemistry of Al-rich biotites coexisting with muscovites in peraluminous granites**

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### **ABSTRACT**

A comparison was made between single-crystal structure refinements, electron microprobe analyses and octahedral site populations of seven biotite crystals and data obtained previously for coexisting muscovite in peraluminous granites using the same methods. Both micas, from several plutons of Northern Victoria Land (Antarctica) and Sardinia (Italy), show significant octahedral substitutions: biotite has a composition characterized by relatively high <sup>6</sup>Al content ( $0.32 \leq {}^{6}\text{Al} \leq 0.59$  apfu), whereas muscovite is characterized by phengite-like substitutions [ $0.12 \leq {}^{6}(\text{Mg} + \text{Fe} + \text{Ti} + \text{Mn}) \leq 0.35$ ]. Mean bond-lengths and electron count data for six biotites-1M (space group *C2/m*, agreement factor  $2.7\% \leq R_{\text{obs}} \leq 3.6\%$ ) and a biotite-2M<sub>1</sub> (space group *C2/c*,  $R_{\text{obs}} = 2.8\%$ ) show that Al substitutes for divalent cations in the octahedral M2 site and that the Fe and Mg distribution is disordered. The mean tetrahedral bond lengths determined for biotite-2M<sub>1</sub> reflect Al-Si disorder. In coexisting muscovite-2M<sub>1</sub> crystals, small positive electron density residuals close to M1 site position as well as the increase in M2 mean atomic number is in agreement with the presence of a significant phengitic component. Reduction in biotite unit-cell dimensions with the increase of Al follows a pattern similar to that of associated muscovites, and the octahedral site volumes of both micas are influenced by the Al saturation index (ASI) of the rock. These results, and the calculated partition coefficients between biotite and muscovite for elements in M sites, are consistent with continuous reaction and re-equilibration of biotite and muscovite during crystallization of peraluminous granitic melts.