

## **Thermal expansion of minerals in the amphibole supergroup**

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### **ABSTRACT**

We have investigated the thermal expansion of 15 naturally occurring chemically diverse amphiboles utilizing high-temperature X-ray powder diffraction. As done in the first paper of this series on pyroxenes, volume-temperature data were analyzed using the physical Kroll and empirical Fei thermal expansion models. As in pyroxenes, orthorhombic amphibole end-members expand more than monoclinic ones, which is related to the greater kinking of the chains of tetrahedra permitted by the *Pnma* symmetry. In the case of chemically similar phases, increased Al in octahedral cation sites decreases expansion. Although the ranges of thermal expansion coefficients for amphiboles and pyroxenes are similar, expansion patterns are not the same. Amphiboles exhibit higher expansion along  $a^*$ , but lower along  $b$ , just the reverse of that observed in pyroxenes. An exception to this is the data for pargasite, which shows higher expansion along the  $b$  axis due to the presence of Al in tetrahedral sites. Current data will be useful in modeling reactions involving amphiboles in both metamorphic and igneous environments.

**Keywords:** Amphiboles, thermal expansion, X-ray diffraction, modeling