

## **High-pressure behavior of clinochlore**

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### **ABSTRACT**

The room-temperature bulk modulus of synthetic end-member clinochlore,  $\text{Mg}_5\text{AlSi}_3\text{AlO}_{10}(\text{OD})_8$ , has been determined in the pressure range 0 to 6.5 GPa using neutron powder diffraction:  $K_0 = 75.4(2.7)$  GPa,  $K'_0 = 4$ ;  $K_0 = 72.3(2.4)$  GPa,  $K'_0 = 5.4(1.0)$ . A structural comparison is made with the related mineral brucite,  $\text{Mg}(\text{OH})_2$ . Clinochlore is a much stiffer structure than brucite ( $K_0 = 41 - 47$  GPa). Both minerals have very similar in-plane compressions of their polyhedral sheets and so their very different bulk moduli arise from different compressibilities normal to the structural layering. Rietveld refinements of neutron-diffraction data for clinochlore collected at 0, 1.2, 2.5, and 4.7 GPa reveal that compression normal to the layering is equally partitioned between the interlayer and the 2:1 layer; the octahedral sheets of the brucite-like and 2:1 layers are uncompressed to 4.7 GPa. Increasing pressure strengthens the  $\text{H3}(\text{D3}) \cdots \text{O3}$  hydrogen bond, which contracts linearly from 1.88(2) Å at 0 GPa to 1.77(2) Å at 4.7 GPa, possibly with a concomitant lengthening of the  $\text{O6-H3}(\text{D3})$  hydroxyl bond from 1.05(2) Å to 1.10(2) Å over the same pressure range.