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Equation of state of dense hydrous magnesium silicate phase A, $Mg_7Si_2O_8(OH)_6$

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ABSTRACT

The isothermal equation of state (EoS) of phase A, $Mg_7Si_2O_8(OH)_6$, has been determined using high-pressure single-crystal X-ray diffraction. A third-order Birch-Murnaghan EoS fit to pressure-volume data collected from room pressure and temperature to 7.6 GPa results in $V_0 = 512.56(3)$ Å^3, $K_0 = 97.5(4)$ GPa, and $K' = 5.97(14)$. Compression of the hexagonal ($P6_3$) structure is anisotropic with the **c** axis, which is perpendicular to the distorted close-packed planes of anions, approximately 23% less compressible than the **a** axis: $K_a = 90.1(5)$ GPa with $K'_a = 5.4(2)$ and $K_c = 116.8(9)$ GPa with $K'_c = 7.5(3)$. The bulk modulus of phase A is intermediate between those of brucite (Br) and forsterite (Fo) and less than those of hydroxylclinohumite and hydroxylchondrodite, in a manner that is entirely consistent with its water content and density in relation to the Fo-Br series of minerals.