

## **High-pressure study on lead fluorapatite**

**XI LIU, SEAN R. SHIEH,\* MICHAEL E. FLEET, AND ARSLAN AKHMETOV**

Department of Earth Sciences, University of Western Ontario, London, Ontario, N6A 5B7, Canada

### **ABSTRACT**

The compressional behavior of a synthetic lead fluorapatite [ $\text{Pb}_{9.35}(\text{PO}_4)_6\text{F}_2$ ] has been investigated in situ up to about 16.7 GPa at 300 K, using a diamond-anvil cell and synchrotron X-ray diffraction. We find that the compressibility of lead fluorapatite is significantly different from that of fluorapatite [ $\text{Ca}_{10}(\text{PO}_4)_6\text{F}_2$ ], chlorapatite [ $\text{Ca}_{10}(\text{PO}_4)_6\text{Cl}_2$ ], and hydroxylapatite [ $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ ]: lead fluorapatite is much more compressible, and elastically isotropic in the investigated pressure range. The pressure-volume data fitted to the third-order Birch-Murnaghan equation yield an isothermal bulk modulus ( $K_T$ ) of 54.3(18) GPa and the pressure derivative ( $K_T'$ ) of 8.1(6). If  $K_T'$  is fixed at 4, the obtained  $K_T$  is 68.4(16) GPa, which is approximately only two-thirds of the isothermal bulk modulus of the calcium apatites.

**Keywords:** Lead fluorapatite, compressibility, synchrotron X-ray diffraction, isothermal bulk modulus, high pressure