

Single-crystal elastic properties of $\text{Ca}_{0.07}\text{Mg}_{1.93}\text{Si}_2\text{O}_6$ orthopyroxene

JEAN-PHILIPPE PERRILLAT,^{1,*} FABRIZIO NESTOLA,^{2,†} STANISLAV V. SINOGEIKIN,¹ AND JAY D. BASS¹

¹Department of Geology, University of Illinois, Urbana, Illinois 61801, U.S.A.

²Bayerisches Geoinstitut, Universität Bayreuth, 95440 Bayreuth, Germany

ABSTRACT

The single-crystal elastic properties of $\text{Ca}_{0.07}\text{Mg}_{1.93}\text{Si}_2\text{O}_6$ orthopyroxene (space group *Pbca*) have been investigated by Brillouin spectroscopy at ambient conditions. The aggregate bulk and shear moduli, $K_{0,S} = 102.5$ GPa (1.5) and $\mu = 74.2$ GPa (1.1), respectively, are ~5% and ~3% lower than commonly accepted values for MgSiO_3 end-member ($K_{0,S} = 107.6$, $\mu = 76.8$ GPa). These results indicate that the incorporation of small amount of Ca in the orthoenstatite structure does not greatly affect its elastic properties. As a consequence, the increase in bulk modulus reported in natural orthopyroxenes relative to the Mg-end-member is not related to the substitution of Ca in the M2 octahedral sites, but more probably to the substitution of Al in tetrahedral sites.

Keywords: Brillouin spectroscopy, elastic properties, enstatite, orthopyroxene