# Elastic properties of pyroxene polymorphs of $MgSiO_3$ and implications for seismic models and discontinuities in the Earth's upper mantle.

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Pyroxenes are important mineralogical constituents of petrological models of the Earth's upper mantle. In the pressure and temperature range of the upper mantle, $MgSiO_3$ pyroxenes exhibit various polymorphs, including orthoenstatite [OEN], protoenstatite [PEN], low-pressure clinoenstatite [LPCEN] and high-pressure clinoenstatit [HPCEN]e. To construct mineralogical models for Earth's mantle, the pressure and temperature derivatives of the compressional and shear wave velocities of these different polymorphs are essential. In a series of ultrasonic interferometry experiments at high pressures and temperatures in solid-medium, multi-anvil apparatus, we have measured sound velocities in the OEN, HPCEN and LPCEN phases, as well as during the transitions between these phases [Kung et al., 2004, 2005a, 2006]. In ultrasonic experiments in an internally-heated, gas-medium apparatus, we have measured the wave velocities of an OEN specimen to temperatures of 1373K at 300 MPa [Kung et al., 2005b]. During the course of these ultrasonic experiments, we observe anomalous elastic behavior in these polymorphs, transitions between the polymorphs, and obtain robust data at high P & T for their elastic properties. These data are used to compare with seismic observations for the Earth's upper mantle, in terms of various petrological models, following the approach suggested in Green and Liebermann [1976].