Deciphering the Distribution of Partial Melt in the Asthenosphere with Converted Seismic Waves

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The global distribution of partial melt in the asthenosphere remains uncertain, but recent constraints on mantle velocity gradients obtained with Sp converted phases are providing new insight. Beneath the Anatolian region, Sp phases reveal strong positive velocity gradients at depths of 100-150 km that correspond to the base of an asthenospheric low velocity layer imaged in multiple tomographic models. Interpretation of this shear velocity gradient as the onset of hydrous partial melting, where partial melt at shallower depths reduces velocities, is consistent with
primary magma equilibration conditions from basaltic samples in the region. Globally, a similar velocity gradient is observed in regions with low velocity mantle at ~150 km depth. If this widespread feature represents the onset of hydrous partial melting, partial melt would be present in the upper mantle beneath more than a third of the Earth’s surface.