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# Deformation microstructures and seismic anisotropy of the lithospheric mantle beneath the SE Tibetan Plateau: constraints from mantle xenoliths from Maguan, Yunnan Province, China

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SKS wave splitting measurement in recent years reveal strong and complex seismic anisotropy in the upper mantle beneath the SE Tibetan Plateau. Seismic anisotropy is generally attributed to the crystallographic preferred orientation (CPO) of olivine in the upper mantle. To better understand the deformation mechanism and seismic anisotropy of the upper mantle in this region, we performed detail studies on the deformation microstructures and seismic anisotropy, as well as chemical compositions of the mantle peridotite xenoliths collected from Maguan, Yunnan Province.

The xenoliths, hosted by Miocene potassic volcanic rocks, are mainly spinel lherzolites with few spinel harzburgites. Some microstructures of 120° triple junctions, subgrain boundaries and weak undulose extinction in olivine and pyroxene grains reflect the peridotites underwent plastic deformation followed by static recrystallization. Olivine in the xenoliths has Fo between 89.7 and 91.0 and contains 0.05 wt.% - 0.10 wt.% CaO, indicating they originate from the upper mantle. Calculated equilibrium temperatures and pressures of the peridotite xenoliths predominantly range from 1006 to 1148 °C and 1.58 to 2.22 GPa, respectively. CPO data show that the dominant fabric of olivine is AG-type, with few samples displaying quasi-A-type CPO. The CPO of orthopyroxene and clinopyroxene is characterized by their [001] sub-parallel to the [100] of olivine. Seismic anisotropy calculated based on the olivine and pyroxene CPO data displays that the polarization anisotropy (AVs) is highest in direction nearly normal to the highest density of olivine [010] for AG-type fabric and sub-parallel to the [010] of olivine for A-type, respectively. These peridotite xenoliths with AG-type fabric have moderate to strong AVs ranging from 3.1 % to 7.0 % with 4.6 % in average in large circle girdles of [100] and [001], whereas AVs is very weak in the direction approximately normal to slip plane.

The CPO types of olivine and pyroxene indicate that the upper mantle deformation is dominated by dislocation creep under high temperature, dry and low stress conditions. If the strong SKS wave splitting observed in SE Tibetan Plateau (Yunnan Province) results from AG-type olivine fabric, the lithospheric mantle in this region is expected to be at least 130 km thick and characterized by vertical foliation which is probably generated by vertical upwelling mantle, because a horizontal foliation would result in isotropy for SKS waves. Given that the thickness of the lithosphere in SE Tibetan Plateau is much less than 130 km, our preliminary results imply that the asthenosphere may contribute greatly to the SKS wave splitting.