Insight into the NE Tibetan Plateau expansion from crustal and upper mantle anisotropy revealed by shear-wave splitting

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The northeastern Tibetan plateau margin is the current expansion border, where growth of the plateau is ongoing. We analysed shear-wave splitting at ChinArray stations in the NE Tibetan Plateau and its margin with the stable North Chine Craton. The measurements provide important information on the seismic anisotropy and deformation patterns in the crust and upper mantle, which can be used to constrain the expansion mechanism of the plateau. Along the margin and within the craton, the dominant NW-SE fast polarization direction (FPD) is NW-SE, subparallel to the boundary between the plateau and the North China Craton. The shear-wave splitting measurements on the NE Tibetan Plateau itself generally reflect a two-layer anisotropy. The lower-layer anisotropy (with NW-SE FPDs) is consistent in the whole region, and FPDs are the same as those in the North China Craton. The upper-layer FPDs are parallel to the boundary orogens and faults along the NE Tibetan Plateau margin and are parallel to crustal motion rather than surface structures within the high plateau. The two-layer anisotropy implies the presence of deformed Tibetan lithosphere above the underthrusting North China Craton. The NE Tibetan Plateau shows similar deformation patterns at the surface (inferred from GPS) and within the mantle (inferred from shear-wave splitting), but significant crustal anisotropy (parallel to crustal motion) requires mid-lower crustal channel flow or detachment to drive further tectonic uplift of the plateau.

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