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Frozen-in anisotropy in Emeishan large Igneous Province and its implication for Plume-lithosphere interaction

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Large Igneous Provinces (LIPs) are surface expressions of the interaction of mantle processes with the Earth's crust and are believed to have triggered multiple global mass extinctions. Unravelling the emplacement of LIPs could offer vital information in understanding the formation of the Earth's crust as well as its potential environmental consequences. However, our understanding of mantle-lithosphere interaction in LIPs still limited, particularly for ancient ones, due to lacking detailed structure beneath LIPs. Here we present a three-dimensional radial seismic anisotropy model as well as shear wave velocity (Vs) in Emeishan large igneous province (ELIP), southwest of China, which is notable for its plume origin. Our results show a negative radial anisotropy (i.e. vertical Vs larger than horizontal Vs) from shallow crust with a broad zone extending to mid-low crust and uppermost mantle. Together with evidence from the previous geochemistry, petrologic and geophysical studies, we interpreted this negative radial anisotropy result from frozon-in anisotropy caused by upwelling mantle plume as a dominate transport form of dike system beneath the Yangtze block. This study offers a direct seismic evidence for LIP formation as a result of plume-lithosphere interactions.