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Crustal Structure and earthquakes beneath the Eastern Himalayan Plate Boundary System, Northeast India

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We use data from 24 broadband seismograph stations located south of the Eastern Himalayan plate boundary system to investigate the crustal structure beneath northeast India and understand its relationship to active faulting. P-wave receiver function analysis reveal felsic continental crust beneath the Brahmaputra Valley, Shillong Plateau and Mikir Hills, and mafic thinned passive margin transitional crust (basement layer) beneath the Bengal Basin. Within the continental crust, the central Shillong Plateau and Mikir Hills have the thinnest crust (30±2 km) with similar velocity structure, suggesting an unified origin and uplift history. North of the Plateau and Mikir Hills the crustal thickness increases sharply by 8–10 km and is modelled by ∼30° north dipping Moho flexure. South of the Plateau, across the ∼1 km topographic relief of the Dawki Fault, the crustal thickness increases abruptly by 12-13 km and is modelled by down-faulting of the Plateau crust, overlain by 13–14 km thick sedimentary layer/rocks of the Bengal Basin. Further south, beneath central Bengal Basin, the basement layer is thinner (20–22 km) and has higher (∼4.1) indicating a transitional crystalline crust, overlain by the thickest sedimentary layer/rocks (18–20 km). Our models suggest that the uplift of the Shillong Plateau occurred by thrust faulting on the re-activated Dawki Fault, a continent margin paleo rift-fault, and subsequent back-thrusting on the south dipping Oldham Fault, in response to flexural loading of the Eastern Himalaya. Our estimated Dawki Fault offset combined with timing of surface uplift of the Plateau reveal a reasonable match between long term uplift and convergence rate across the Dawki Fault with present day GPS velocities.