Seismic imaging of the deep crustal structure beneath Eastern Ghats Mobile Belt (India): Crustal growth in the context of assembly of Rodinia and Gondwana supercontinents

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We present the first high resolution seismic images illuminating the hitherto-elusive crustal architecture beneath the Eastern Ghats Mobile Belt (EGMB) using teleseismic receiver functions. Data were collected using 27 broadband seismic stations operated in a continuous mode covering two distinct seismic profiles (~550 km long) during 2015–2018. Several interesting observations and inferences are made through analysis of the receiver functions such as (a) a very thick crust (>40 km) with oppositely dipping Moho beneath the EGMB and Archean Bastar Craton, (b) EGMB formed from amalgamation of different crustal domains thrust over one another possibly during the Pan-African orogeny, (c) the Archean Bastar Craton crust extends (~75 km) eastward beneath the EGMB, from its surficial geological boundary, (d) there is a sharp contrast in the crustal structure (with ~20 km Moho offset) at the contact between the Rengali Province and Singhbhum Craton which does not support southward growth of the Singhbhum Craton through accretion, (e) anorthosite complexes may possibly be created by rising diapirs channeled through the weak zones in the crust, from the magma chambers developed by melting of frontal portion of the underthrusting lower crust. We report a significant change in the crustal architecture just east of the most elevated topography observed along the profile covering the Bastar Craton and the EGMB. It requires further careful petrological investigations to ascertain the relationship of high elevation and its linkages with the deep crust, forming a separate domain. Our results do not support or discard a Grenvillian age (~1 Ga) docking of the EGMB with Proto-India, though it is preferred to explain the present day crustal features with intense Pan-African (0.5–0.6 Ga) reorganization.