9 Glimpses of the Indian Crust from Kanayakumari to Karakorum

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I here review here the state of knowledge about the nature of the Indian continental crust from its southern end to the northern extremity. Most of the observations came from a series of specifically designed network of over 300 broadband seismographs operated by us.

Data from distributed network of seismograph location encompassing geological domains like mid to late Archean Dharwar craton, Archean and Proterozoic metamorphic terrains, Proterozoic basin, rifted margins and escarpments, and Deccan volcanics suggests:

Except for the mid to lower crust exhumed Archean terrains (of West Dharwar and Southern Granulite) all other geological domains have crustal thickness in the range 33-40 km. In the western Dharwar, crustal thickness increases from ~40 km in the north to over 50 km in the south. The Archean domain of granulite terrain is thicker (40-45 km) and more mafic compared to its counterpart deformed at 550 Ma. Most of the crustal blocks have low to moderate Vp/Vs (1.72-1.76) and S- wave split delay time of 0.15-0.25 s representing a felsic to intermediate composition. Exception to the above include Archean granulite terrain with high Vp/Vs (1.76-1.81), and larger split time (upto 0.45 s) suggestive of more mafic crust beneath them. When accounted for the paleo-burial depth of 15-25 km, the study suggests a possible Himalaya- Tibet like scenario beneath the south western Dharwar and north granulite terrain whose deeper crust progressively densified. This led to a gradational crust- mantle transition that is otherwise sharp elsewhere. The study suggests a more homogenized and felsic nature of the Precambrian crust beneath the terrains formed after 2.6 Ga, possibly due to delamination of the mafic lower crust. Our study does not suggest any distinction between late Archean and Proterozoic crust. A West- east coast broadband seismic profile (close to the Kavalli-Udipi) crossing the Dharwar craton suggest a Moho offset beneath the western and eastern Ghats and also in the continental interior.

The Deccan volcanism at 65 Ma does not appear to have the altered the character of the crust beneath it and is similar to the adjoining late Archean east Dharwar craton.

Central and north India cratons have characteristic crustal signature comparable with those of the eastern Dharwar. The Proterozoic domains of Central India could easily be identified as the alterations of the Archean domain as seen by presence of a thick basal crust above the Moho. Presence of a highly felsic crust beneath the north India, argues against the melting of the Indian crust beneath the southern Tibet and its southward channel flow as the source for the presence of young granite in the Higher Himalaya.

In the Himalaya- section we mapped the India crust dipping at an angle of 3-6 degree beneath the lesser Himalaya that increase to over 16degree locally beneath the

MCT and that continues at an angle of ~6 deg further northward. This is possibly the first direct evidence for the presence of ramp structure. The Moho depth increases from ~40 km beneath the northern edge of the Indian craton to over 75 km beneath the Karakorum. Northern limit of India crust has always been debated. Our observations beneath the Ladakh , together with other similar measurements from western Tibet suggest that Indian crust continues northward past the Karakorum fault upto Altyn Tagh. These observations have significant bearing on modeling the strain rate on the Indian crust.