



Continent like thick lithosphere beneath the western Bay of Bengal (NE Indian Ocean) inferred from 3-D surface wave seismic imaging

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We present shear wave velocity image of the crust and uppermost mantle beneath Bay of Bengal and Bangladesh and the adjoining Indian craton from Rayleigh wave group velocity maps generated using ambient noise and earthquake ray paths at periods from 10s to 70s with horizontal resolution of 1° to 2° . The group velocity variation with time period at each node is then inverted in terms of velocity-depth image to reconstruct 3-D shear velocity of the crust and uppermost mantle from a depth of ~ 10 km to 140 km. The velocity image is extracted from a recent regional 3-D tomography of South Asia region using 21,615 ray paths (Saha et al., 2018). The structure of Bay of Bengal and Bengal basin that evolved around 130 Ma with the breakup of India from eastern Gondwanaland has been subject of several recent studies. The Bay of Bengal has been affected by Kerguelen and Crozet hotspots in form of 85° and 90° E ridges. Lithospheric character of the Bay of Bengal has remained enigma in absence of any detailed seismological investigation.

The plate cooling model and theoretical consideration suggest a lithospheric thickness of about 90 km for oceans of age beyond 90 Ma. The bottom of an oceanic plate (lithosphere) generally corresponds to the top of the seismic low-velocity layer. Mapping of such a lithosphere-asthenosphere boundary (LAB) is within the realm of our seismic images. Further, the effect of increasing lithospheric age is to shift the low velocity zone to deeper depth and increase the value of minimum velocity. Considering an ambient V_s of 4.7 km/s, for a 100 Ma oceanic lithosphere the minimum shear velocity is expected to be around 4.3 km/s. Using the above two parameters like depth to the low velocity and the minimum shear velocity, we infer: (i) over 135 km thick high velocity lithosphere beneath the western Bay of Bengal (upto $\sim 86^\circ$ E). This high velocity structure is continuous with similar image over the adjoining India craton. Further east (86° - 92° E) the lithosphere thickness drops significantly to ~ 80 - 90 ; (ii) beneath the northern Bay of Bengal, Bengal basin and Bangladesh (14° - 26° N) a 90-100 km thick lithosphere, similar to those observed over an old ocean floor.

Our investigation suggests a mixed continent-ocean lithospheric structure beneath the NE Indian Ocean (Bay of Bengal and Bengal basin) with the evidence for continental lithospheric root extending to over 300 km from the coastline. We have redefined the continent-ocean boundary in NE Indian ocean which has significant bearing on tectonics and hydrocarbon exploration strategy.