S-wave velocity structure of the lithosphere beneath the western Dabie Mountain, China

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The Dabie orogenic belt is well known ultrahigh-pressure (UHP) metamorphic terrane in the world, formed by the Triassic continental collision between the Yangtze and the North China plates. A broadband digital seismic array consisted of 7 stations first was established in area of the western Dabie Mountain (31°20´~31°50´N, 114°30´~115°E) from May to November 2001. A total of 39 recorded teleseisms are analyzed to determine the S-wave velocity structure of the lithosphere beneath the array by modeling the radial receiver function. There exists obvious lateral variations of S-wave velocity distribution with depth in this area. A high-velocity zone of 2-4 km thick is found to locate in 2-4 km depth, which may represent eclogite-bearing UHP slices exhumed to the shallow crust. Crustal thickness beneath the array is about 32-36 km, indicating that no "mountain root" exists in this region. The crust-mantle boundary appears as a flat, north-dipping, first-order velocity discontinuity. However, the Moho rise suddenly to 32 km depth in the north margin of the array. The change of Moho depth implys that the Yangtze plate subducted under the North China plate. The flat Moho beneath the western Dabie Mountain probably resulted from the largely-scale crustal remelting, magma differentiation and separation after the formation of the Dabie Mountain. In the lowermost crust of the southern array, a high-velocity body produces a significantly thickened transition zone from the crust to upper mantle. It may result from the underplate of mafic mantle magma into the lower crust, which is generally associated with a large-scale extension triggered by delamination of the lithospheric mantle. In the north margin of the array, a north-dipping, EW-striking low-velocity zone in the upper mantle may be related to the collision boundary between the Yangtze and the North China plates. It reflects the upwelling mantle under the orogenic belt along the collision boundary. We suggest that the Tongcheng-Tongbai shear zone is the southern boundary of suture zone between the Yangtze and the North China plates. When the Yangtze plate was subducted along the zone deeper than the depth required for eclogite-facies metamorphism, the mafic granulites of the lower crust changed into eclogites.