Seismological Investigations of the Upper Mantle, Transition Zone and Uppermost Lower Mantle around Taiwan

C. Wright

Institute of Earth Sciences,Academia Sinica,

P.O. Box 1-55,Nankang, Taipei,Taiwan 11529.

P waves from earthquakes south of Taiwan, recorded by the BATS seismic array and CWB seismic network, were used to define two average *P*-wavespeed models (WPSP01P and WPSP02P) between depths of 100 and 800 km below the western margin of the Philippine Sea plate in the Luzon region. The presence of a low wavespeed zone in the upper mantle is inferred, although the details are unclear due to the extreme complexity of the seismic records. Wavespeeds in the upper mantle are similar to those measured in other oceanic plates. The estimated depths of the 410- and 660-kilometre discontinuities are 325 and 676 km, and involve relatively low wavespeed jumps of 0.6-1.0% and 1.1-1.5% respectively. The unusually shallow depth of the upper discontinuity is inferred by clearly resolving the travel-time branch produced by refraction through the transition zone. The 660-kilometre discontinuity is slightly deeper than usual, while the wavespeed gradients within the transition zone between depths of 460 and 610 km are higher than in most other *P*-wave models of the transition zone, with no evidence for a 520 km discontinuity. Independent support for the validity of the models was obtained by phase-weighted stacking on a cluster of short-period seismograms with first arrival energy from within the transition zone. The stacking enabled the detection of later signals with times and slownesses close to those predicted by model WPSP02P for energy emerging from both the lowermost upper mantle and the top of the lower mantle.

A possible explanation for elevated 410-kilometre discontinuity in the northern part of the region near 16^{o}N is that seismic energy reaches its maximum depth within or close to the cool, subducted oceanic South China Sea plate where subduction has been slow and relatively recent. Further south, however, around 13^{o}S, the presence of a broken remnant of the South China Sea plate, formed during a period of shallower subduction, is suggested at depths below 300 km to explain the broad extent of the elevated 410-kilometre discontinuity.