UPPER MANTLE VELOCITY STRUCTURE BENEATH THE TIBETAN PLATEAU FROM TRIPLICATED SEISMIC *P* WAVEFORMS

Risheng Chu, B.S.

Advisor: Lupei Zhu, Ph.D.

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Abstract

In this study, P-wave waveforms in the upper-mantle distance range between 12° and 30° were analyzed to investigate upper-mantle P velocity structures beneath the Tibetan Plateau and surrounding areas. The waveform data were from 1,715 earthquakes of magnitudes larger than 5.0 between 1990 and 2005 that occurred within 30° from the center of the plateau. I first used teleseismic recordings of these events to verify their focal mechanisms from the Harvard CMT solutions and found 504 events with good focal mechanisms. I then developed a new method to estimate their source time functions and focal depths. For each event, I used the theoretical Green's functions to deconvolve with the teleseismic P-wave waveforms to obtain the source time function. The focal depth of the event was adjusted until the source-free P waveforms match the theoretical Green's functions. By using the method I obtained source time functions and depths for the 504 events. Comparison with the Harvard CMT solutions showed that Harvard CMT catalog systematically over-estimated both the source durations and depths.

I divided the studying area into 6 regions and modeled upper-mantle-distance P waveforms with turning points beneath each region separately. The results show that the upper-mantle P-wave velocity structures beneath India, the Himalayas and the Lhasa Terrane are similar and contain a high-velocity lid about 250 km thick. The Tarim Basin also lies above a high-velocity upper-mantle lid. The upper-mantle velocities over 200 km beneath the Qiangtang and Songpan-Ganzi Terranes are lower than those in the north and south, especially beneath the Songpan-Ganzi Terrane. The 410 discontinuity beneath these two terranes are elevated by 20 km. I also found high-velocity anomalies in the transition zone below 500 km under the Lhasa and Qiangtang Terranes. The results suggest that the Tibetan Plateau was generated by the thrusting of the Indian mantle lithosphere under the southern part

of Tibet. A portion of the thickened Asian lithosphere in northern Tibet was delaminated and is now sitting atop of the 410 discontinuity below it. The high-velocity anomalies in the transition zone beneath the Lhasa and Qiangtang Terranes are probably the remnants of subducted India mantle lithosphere.