LOVE AND RAYLEIGH WAVE PHASE VELOCITIES OVER UNITED STATES CONTINENTAL PATHS

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The surface waves of nine earthquakes, with propagation paths crossing the central portion of the conterminous United States, were chosen for analysis. The Love and Rayleigh waves were digitized from the seismograms of both the World Wide Standardized Seismic Network stations and the Long Range Seismic Measurements stations. The use of both networks of stations provided a greater number of possible profiles in the area of interest, approximately that bounded by the Rocky Mountains on the west and the Appalachian Mountains on the east. A total of 95 profiles was used in this study.

The digitized data were Fourier analysed between the periods of 10 and 70 seconds, and corrected for instrumental effects. The phase velocities between pairs of stations were computed, using the difference in arrival times of the Fourier components at each of the two stations of a pair. An iteration-least squares inversion process involving the use of the partial derivatives of phase velocity with respect to shear velocity was applied to the observed Love wave and Rayleigh wave phase velocities. The shear

velocity distribution down to a maximum depth of 200 km. was obtained which best satisfied both the observed Love wave and the observed Rayleigh wave phase velocities. An earth model of 15 layers (for the depth of 200 km.) was used, allowing more detailed shear velocity distributions than have been obtained with thicker layered models. The calculations of the Fourier analysis and phase velocity and the inversion procedures were performed on the IBM 360/50 computer at Washington University, St. Louis, Missouri.

The results of the phase velocity inversions show the crust to be slightly greater than 40 km. in the north-central United States. The crust thickens to nearer 50 km. under the southern part of the Canadian Shield, Lake Michigan and the northern Appalachian Mountains. The western edge of the Great Plains area has a crust which is close to 50 km. thick, perhaps greater, and which thins towards a thickness of 40 km. in northern New Mexico. In southern Arizona and southern New Mexico, the crust is about 40 km. thick, as it is in the central United States and Gulf Coast areas.

Except for the Gulf Coast area, most of the profiles indicate a low velocity channel in the crust and in the mantle. The low velocity channel in the

crust begins at a depth of about 21 km., and extends to a depth of about 26 km. The low velocity channel in the mantle usually lies between the depths of 80 and 180 km., though occasionally there is evidence that the lower boundary of the low velocity channel extends to depths greater than 180 km. For those profiles for which the low velocity channel is thinner, the channel often begins between 60 and 80 km. deep.

In the Gulf Coast area the evidence for the low velocity channels in the crust and mantle indicates that the low velocity channel in the crust disappears, and the low velocity channel in the mantle either disappears or its depth is beyond the range of the data.