DETERMINATION OF CRUSTAL Q STRUCTURE
FROM MULTI-MODE SURFACE WAVES

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Determinations of Q structures are made using a new method which matches theoretical and observed surface wave spectra. The importance of the method lies in its ability to utilize relatively short paths between a single source and a single receiver, both of which are preferably located within a single geologic province.

In order to obtain theoretical Rayleigh wave spectral amplitudes at relatively short periods, improvements are made to existing computational schemes for computing the displacement-stress eigenfunctions as functions of depth. The effects of focal depth variations on the Rayleigh wave spectra for both fundamental and higher modes are studied. Inclusion of higher-mode data not only broadens the data base, but is also helpful when there is focal depth ambiguity.

The method has been applied to study the regions of the eastern United States, the Colorado Plateau, and the Basin and Range province. Q models have been obtained both through trial-and-error procedures and with an inversion scheme developed for that purpose. Models for each region obtained from these two procedures are in good agreement. Q_β values in the upper crust, as obtained from inversions, are 275 for the eastern United States,

160 for the Colorado Plateau, and 85 for the Basin and Range province. Q_β values in the lower crust, although not well determined, can be characterized by a high value of 2000 in all three regions. The results are consistent with those of Mitchell (1975), that Q_β values in the upper crust of the western United States are about half those of the eastern United States. These new results show also that substantial variations of Q_β occur in different regions of the western United States. The upper crustal Q_β values show an inverse relationship to heat flow values in the United States.