

**LATERAL VARIATION OF SURFACE WAVE
VELOCITY AND Q STRUCTURE
BENEATH NORTH AMERICA**

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A Digest Presented to the Faculty of the Graduate
School of Saint Louis University in Partial
Fulfillment of the Requirements for the
Degree of Doctor of Philosophy

1985

DIGEST

Surface wave group velocities and attenuation coefficients for fundamental- and first higher-mode Rayleigh and Love waves were obtained for paths across eastern North America, and for a portion of western North America largely confined to the Basin-and-Range province. A combination of data obtained using single- and two-station methods provides information which spans the period range 4 to 140 seconds for fundamental-mode data and the period range 4 to 20 seconds for first higher-mode data.

Simultaneous multi-mode surface wave inversion has been employed to derive shear velocity models of both regions. The main characteristics of the model of eastern North America are consistent with the model of Mitchell and Herrmann (1979) in which an upper mantle shear wave low-velocity zone is, at most, a very minor feature and is not resolvable from the data. The shear velocity model of western North America has a well-pronounced low-velocity zone in the upper mantle at depths between 65 km and 230 km with shear velocity decreasing from 4.57 km/sec at the top of the mantle to a minimum value of 4.01 km/sec at a depth near 110 km. A low-velocity zone is required in the upper crust of western North America at depths between 12 km and 20 km, if higher mode data are included in the inversion, but is not required by fundamental mode data alone. Anisotropy of elastic properties is not required for any depth range in either eastern or

western North America.

Attenuation coefficients of surface waves in western North America are much higher than those in eastern North America, especially at short periods. The Q_β model obtained for eastern North America has relatively low values of Q_β (~ 300) in the upper crust and high Q_β values in the lower crust and upper mantle. The Q_β model obtained for western North America has a low Q zone in the uppermost crust in which Q_β values are about 80, overlying a lower crust with higher Q_β values. A well-developed low- Q zone occurs in the upper mantle at depths between 60 km and 220 km with the lowest Q_β value near 50.

The low-velocity and low- Q zones are nearly coincident in the upper crust and upper mantle of western North America. From available geological and geophysical evidence, we believe that fluid motion through cracks in the upper crust and partial melting in the upper mantle are the most likely mechanisms for explaining Q variations of eastern and western North America.