STRUCTURE FROM NEAR EARTHQUAKE SURFACE WAVES

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The study of two earthquakes with completely different paths which have gone through geologically different regions is used in order to infer a crustal structure for these regions and to infer the effect of regional structures on the propagation of surface waves. The Michigan shock of August 9, 1947 of intensity VI on the Mercalli tables and the Oklahoma shock of April 9, 1952 of the same intensity were used. These two earthquakes were chosen for the empirical study of Love and Rayleigh wave dispersion because of their magnitude and their geographical location. The Michigan earthquake has its great circle path through the Illinois basin to St. Louis, and the Oklahoma earthquake has its great circle path from the epicenter to St. Louis through the Ozark dome.

The usefulness of surface waves in the study of surface structure lies in the fact that they exhibit a variation of velocity with wave length when there are elastic or density discontinuities at depths below the surface close to the same order of magnitude as the wave length. These variations are known as dispersion and they are observed on the seismograms as a change in the period of successive cycle of waves with time. The

nature of the dispersion depends mainly on the depth of the discontinuity and on the physical properties of the elastic constant of the material above and below the interface.

The observed dispersion curves derived from the seismograms show that the group velocities of surface waves in the 1/4 to 15 second period range going through the Ozark dome behave like the dispersion curve as predicted for the sediment-free crust by Oliver and Ewing and the group velocities of surface waves going through the Illinois Basin are appreciably lower due to the thickness of sediments.

A physical inference was attempted for these regions, using the observed Love and Rayleigh wave dispersion curves and by comparing these results with the calculated theoretical dispersion curves for different models. The models used were based on velocity distributions found by previous investigators and also on the velocities found in this study. The observed dispersion curves did not fit any of the seven theoretical models. This in part is due to the need of more data since the period range was limited to 15 seconds and the data seem to be greatly scattered.