SEISMIC VELOCITY AND Q MODEL FOR THE SHALLOW STRUCTURE OF THE ARABIAN SHIELD FROM SHORT PERIOD RAYLEIGH WAVES

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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

1987

DIGEST

The shear velocity and Q_β structure for the upper 1 km in different tectonic regions of the Arabian shield has been investigated using high frequency, vertical-component records of Rayleigh waves (1-20 hz) that were recorded to distances of 55-80 km during a deep seismic refraction survey. The group and phase velocity of the fundamental and first higher modes were determined and used to invert for the shear wave seismic velocity structure. The Rayleigh-wave attenuation coefficients are determined from the decay of the amplitude spectrum of the fundamental mode and used to invert for the Q_β structure. These models are used to calculate synthetic seismograms of the fundamental and the first higher modes using wave integral theory. A center of compression is used to represent the source, and a step and a Dirac delta source-time functions were tested. The results indicate that an impulsive source-time function produces the best fit with the observed data. The shear wave velocity of the shield increases from 2.6 km/sec to 3.4 km/sec in the upper 400 m of the crust. Q_β increases from 30 in the upper 50 m to 150 at 500 m depth. The underlying material has Q_β of 400-500 for the outcropping igneous rocks such as granite and may reach values higher than 700 for the metamorphic green schist rock. The procedure can also be applied to seismic exploration data.