DETERMINATION OF AN EARTHQUAKE FAULT AREA AND RUPTURE VELOCITY FROM THE SPECTRA OF LONG PERIOD P WAVES

by

Ali Sayman, B. Sc.

A Digest Presented to the Faculty of the Graduate School of Saint Louis University in Partial Fulfillment of the Requirements for the Degree of Master of Science (Research).

1970

DIGEST

When an earthquake occurs, seismic waves are radiated from the focus through the earth and arrive at points on the earth's surface. During propagation these waves are affected by geometric spreading and absorption and by the transfer properties of the mantle and crust. The spectra of the waves radiated also depend on the direction of rupture at the source and on the velocity of rupture propagation. The latter effect causes some frequencies of the radiated waves to interfere with others, resulting in azimuth-dependent minima in the spectra of the waves.

As our model of the release of energy that occurs during an earthquake we take a plane radiator (fault plane) that is rectangular in shape and that radiates its energy into a perfectly elastic medium according to a prescribed time function. This time function is described by the propagation of a fracture front as it sweeps with a constant velocity across the fault plane.

Ben-Menahem et al. (1965) considered the effect of the medium and of the instrument as a linear filtering process. The effect of the instrument response

was removed using the instrument response curve. The mantle propagation effects, idealized to consist of geometrical spreading and a frequency dependent attenuation factor, were removed in the way described by Teng and Ben-Menahem (1965).

In this study the earthquake analyzed occurred in the Aleutian Islands on February 6, 1965 (53.2° N, 161.2° W; O = 01 - 40 - 33 GCT). The magnitude of the earthquake was 6.5 on Richter scale, and the depth of focus was restrained to 33 km. The P-wave portions of the signal from records of WWSSN stations are digitized and the P wave spectra obtained. Minima corresponding to the effect of depth of focus are identified. A least square approach is employed to select the fault length-fracture velocity combination that best satisfied the observational data.

This interpretational procedure yielded the desired fault parameters for the earthquake studied. The fault conforms to the bilateral-bidirectional model.