SPECTRA SCALING OF EARTHQUAKES IN SOME EURASIAN AFTERSHOCK SEQUENCES

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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

1976

DIGEST

An earlier study of about 300 intermediate size, shallow-focus earthquakes in Eurasia showed that some earthquakes in aftershock sequences have m_b:M_S values close to those of explosions. We define these earthquakes as anomalous earthquakes in this study.

Evernden (1975) stated that anomalous earthquakes can be explained by focal depth and/or focal mechanism rather than by source dimension and/or stress drop. On the other hand, several authors (Molnar and Wyss, 1972; Tatham et. al., 1975; Forsyth, 1975) suggested that anomalous events are closely related to stress drop and/or source dimension.

In this study, we determined the spectra of P waves and found their corner period and asymptotic slope, which can be interpreted in terms of source finiteness (Hanks and Wyss, 1972; Forsyth, 1975) and fractional stress drop (Brune, 1971). We also determined the amplitude spectra of Rayleigh waves in order to find the focal depth and seismic moment and to compare M_S values determined in the time domain with amplitude levels at 20-second period in the frequency domain.

Our result indicates that anomalous earthquakes have shorter corner periods and higher asymptotic slopes compared to non-anomalous earthquakes with the same focal depths and focal mechanisms. This implies that anomalous earthquakes may be associated with smaller source dimensions and/or high fractional stress drop (complete release of stress). We also noted that the magnitude differences in the time domain agree with or scale as $\log_{10}^{A}$ differences in the frequency domain.

We found and discussed three regions of anomalous earthquakes, namely Szechwan Province of China, Tibet and Iraq-Iran border, and one region of non-anomalous earthquakes, the New Hebrides Islands. Our data agree with the suggestion that anomalous earthquakes may result from the formation of fresh faults within homogeneous plates (Molnar and Wyss, 1972).