KINEMATIC PARAMETERS OF EARTHQUAKES

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Faulting of the earth material in the focal region is generally accepted as the process by which energy is released in earthquakes. It is reasonable to assume that the faulting event commences in a localized region and spreads from that point at a finite rate to cover a final fault area. This type of source is referred to as a finite moving source. The length and breadth of the fault plane, and the velocity of rupture are designated as the kinematic parameters of the earthquake mechanism.

The effect of a two-dimensional finite moving source on the radiation of elastic waves has been examined theoretically by Hirasawa and Stauder (1965). It has been demonstrated that the amplitude spectrum of body waves from such a source is characterized by sequences of minima at certain frequencies. The frequencies, or the corresponding periods, at which the minima occur are related to the kinematic parameters. In addition to minima in the spectra, there is an azimuthal modulation of the amplitude of body waves. The effect of this modulation is particularly diagnostic for S waves.

In the present study we have used the spectra

of teleseismic P waves and the amplitude of SH waves to determine the fault plane, the fault area, and the rupture velocity for five larger aftershocks of the 4 February 1965 Rat Island earthquake.

The average displacement, the stress and strain drop, and the volume of strain involved in these earthquakes have been estimated using the theory of dislocation.

A relation between the dislocation and the magnitude of the earthquake has been obtained using the empirical relation between the magnitude and the logarithm of the product of the fault length and the square of the dislocation given by King and Knopoff (1968) and the relation between magnitude and the logarithm of fault length proposed by Press (1967). Another relationship that has been derived is between the magnitude of the earthquake and the volume of strain.

The determination of the fault plane for the aftershocks investigated here, in conjunction with the observation that the nodal plane solutions of the aftershocks display a remarkable similarity, has made it possible to infer the direction and type of dislocation involved in the entire episodic activity beginning 4 February 1965. According to Stauder (1968a, b) the focal mechanism of the entire Rat

Island earthquake sequence can be interpreted in terms of the underthrusting of the island arc from the oceanic side. The evidence brought out by the present investigation substantiates this interpretation.

The total dislocation of the thrust type, involved in the main and the aftershocks, obtained by averaging over the island side of the aftershock zone is approximately 24 cm. The total dislocation of the normal slip type occurring under the trench, obtained in a similar way, is approximately 3 cm.

The findings of this investigation also confirm the identification of the 4 July 1966 earthquake to be of the arc-arc transform fault type.

The possibilities of utilizing the P wave spectrum for the determination of the depth of focus of shallow focus earthquakes have also been demonstrated.