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EARTHQUAKE STUDY IN SOUTHERN CALIFORNIA, 1944

B. Gutenberg and C. F. Richter

(Contribution No. 382, Balch Graduate School of the Geological Sciences)

This continues a previous report [see 1 of "References" at end of paper]. Three papers, previously named as in preparation, have now appeared [2, 3, 4].

Study of travel-times for southern California has been rounded off by a paper on minor phases [5]. Certain waves reflected at the 33-km level are strong over limited ranges of distance, in accordance with theoretical expectation.

Results on amplitudes are included in a more general paper [6]. The velocity of $\overline{P}$ in km/sec is given by $v = (5.56 + 0.001h)$ where h is in km. The coefficient of h is a rough approximation only; it indicates increase in the bulk-modulus of elasticity by about three-quarters per cent for a pressure of 1,000 atmospheres. Similar increases in velocity are found for the intermediate crustal layers. Below the MOHOROVIČIĆ discontinuity, velocities of P and S at first increase with depth, but the rate of increase falls off rapidly. Near 80 km the velocity decreases with depth, producing a shadow-zone of small amplitudes for P and S. This disappears when the focus is deeper than about 250 km [13].

Energy-partition among reflected and refracted waves at discontinuities is given a general theoretical discussion [7] which includes many calculated numerical examples. Special values for the surface of the core [8] are used to compute amplitudes for core waves reaching the surface [9]. A theoretical study of modes of generation of seismic waves has been published [10].

To improve statistics of seismicity the magnitude scale for distant, shallow earthquakes has been revised, using observed amplitudes of surface waves [11]. These correspond closely to an absorption given by $k = 0.0002$ per km except for loss of energy in crossing the boundary of the Pacific Basin. If the path grazes the boundary as much as 90 per cent of the energy may be scattered.

To extend the magnitude scale to deep shocks it was necessary to study amplitudes of the principal phases (P, PP, S) for shallow shocks of known magnitude [12]. The absorption-coefficient for longitudinal and transverse waves in the interior of the Earth is about 0.00012 per km. Energy leaving the focus divides about equally between longitudinal and transverse waves. Tables of amplitudes of P, PP, S as functions of distance now can be used in conjunction with data on surface waves to determine magnitudes. For this purpose the reports of stations which give amplitudes for P, PP, S, etc., as well as of maxima, are especially valuable.

These tables and results have been extended to deep shocks [13]. The magnitude of a deep shock is so defined as to make the energy released in two shocks of the same magnitude equal, regardless of focal depth. Magnitudes of 7-3/4 to 8 have been found throughout the range of focal depth; but during the last 40 years these seem to have been less frequent in deep than in shallow shocks, relative to smaller magnitudes. (The greatest known shock with depth over 200 km was that of January 21, 1906, in Japan--magnitude 8. The shock of May 26, 1932, at a depth of 600 km, south of the Fiji Islands, had a magnitude near 7-3/4.) Apparently at depths over 150 km only roughly one-tenth as much energy can be stored as at depths between 15 and 40 km.

Investigation still in progress is being partly reported in a second paper on the seismicity of the Earth [14] which includes new maps and tables of located shocks. About 70 great earthquakes have now been identified for 1904-43 and about 200 major earthquakes for 1922-43. Mechanism of Pacific structural arcs is discussed in connection with the geographical order of the associated features and phenomena.

Compilation of as complete a catalogue of large earthquakes as is possible for the years 1904-22 is under way. A special study of earthquake activity in California includes lists of the larger recent

shocks [15]. H. O. WOOD is preparing a study of the local epicenters thus far located, in their relation to the known fault-structure. J. M. NORDQUIST has reported on his statistical investigations [16]. A beginning has been made on study of all disturbances, large or small, recorded during a selected week. Routine bulletins covering all but the smallest local shocks, and all teleseisms recorded, have been prepared through 1944.

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California Institute of Technology,
Pasadena, California

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(See also pp. 190, 203, 212, 216, 240, 266, 302, and 324)

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