ments, it was found that the one component responded in the desired manner; however, the second component was deflected in the opposite direction from that expected. The trouble was finally located in the base-plate and was apparently due to strains in the casting. It was then necessary to move the electromagnet to a position on the vertical frame and place a small piece of soft iron on the boom. This material was placed well away from the large permanent magnets of the seismometer. This device is very satisfactory and very positive in its action. The instruments were returned to Sitka in 1942 and installed in conjunction with the motor-driven recorder just described.

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RECENT RESULTS OF EARTHQUAKE STUDY IN SOUTHERN CALIFORNIA

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This report covers results which are partly already published, partly in course of publication, and partly still in preparation. The first synthetic study of earthquakes in southern California was published in 1932 [see 1 of "References" at end of paper]. In recent years available data have been much improved, owing to the installation of Benioff seismometers with high magnification at most of the stations, the establishment of new stations, and better chronometer-timing (six time-signals from the Naval Observatory are automatically recorded each day). Much experience in the interpretation of local seismograms has been gained with the continued occurrence of more and larger local shocks. The labor of calculation has been reduced by preparing special tables which quickly yield distances to 0.1 km [2].

Fifty of the larger and better recorded shocks (all but five later than 1937) have been selected for study. Epicenters, origin-times, and preliminary results for travel-times and structures have been published [3]. The mechanism of faulting, as inferred from the direction of first recorded motion, agrees with the result of previous work [4].

Typical travel-times for the region, revised to date [5], are as follows:

$\overline{P} - O = D/5.577$ $\qquad Py - O = 1.2 + (\Delta/6.05)$ $\qquad Pn - O = 6 + (\Delta/8.06)$

$\overline{S} - O = -0.5 + (D/3.26)$ $\qquad Sy - O = 2.0 + (\Delta/3.64)$ $\qquad Sn - O = 8 + (\Delta/4.46)$

where Δ = epicentral distance in km and D = hypocentral distance for focal depth 18 km.

The terms independent of Δ in the equations for Pn and Sn show appreciable variation for shocks in different parts of the region, with maxima of about 9 and 13, respectively, in the shocks of northern Owens Valley east of the Sierra Nevada. This is an effect of the "root" of the Sierra, which has been discussed in connection with mountain roots in general [6].

The travel-times indicate no variation in the thickness of the "granitic" layer, which is about 18 km. Most of the shocks originate near the base of this layer. There is at least one intermediate layer between this and the base of the continental crust (the Mohorovičić discontinuity). The velocity of Py in this layer differs notably from that of the similar wave P* as observed in Europe (6.05 instead of 6.4 km/sec). If this is a single layer, its thickness varies from about 20 km in the coastal area to almost 50 km in the Sierra region.

The term -0.5 in the equation for $\overline{S}$ represents a frequently noticed discrepancy between the apparent origin-times of $\overline{P}$ and $\overline{S}$. The writers attribute this to development of the fault-fracture with speed greater than the velocity of transverse elastic waves, resulting on the average in early arrival of $\overline{S}$ at the observing stations. An exact theoretical discussion is in course of publication [7].

Measurement of recorded amplitudes for the 50 shocks afforded an opportunity to refine and revise the magnitude-scale for local earthquakes [3]. No significant corrections to the standard amplitude-distance curve were required except at short distances. Using additional data from strong-motion instruments at Pasadena and at the stations operated by the United States Coast and Geodetic Survey, the relation of the instrumentally determined magnitude and of the macroseismic intensity to energy-release and to acceleration has been discussed [8]. The method of the magnitude-scale has been applied to determine the variation of amplitude of the principal P- and S-phases individually, which gives information as to the variation of velocity with depth [9].

The following are mean values of elastic constants (cgs) from all available data for the region:

Layer	Bulk-modulus	Rigidity	Poisson's ratio
Granitic	4.5×10^{11}	2.9×10^{11}	0.24
Intermediate	5.5×10^{11}	3.8×10^{11}	0.22
Below intermediate	12.4×10^{11}	6.5×10^{11}	0.28

A new application of the magnitude-scale is in course of development by J. M. Nordquist. In constructing statistics of occurrence of earthquakes, even with the assistance of the magnitude-scale, there has hitherto been difficulty in making appropriate use of data for both larger and smaller shocks, since the larger shocks represent almost the entire release of energy in the period during which they occur. Further, the statistics are imperfect both for the largest shocks, on account of their infrequent occurrence, and for the smallest shocks, on account of incomplete registration and imperfect location. The new method provides a means of correlating the occurrence of large shocks with that of small shocks, and takes account automatically of the imperfect representation at the two ends of the scale. The procedure is to divide the period investigated into equal time-intervals, and to count the number of these intervals in which the largest shock is of a given magnitude (magnitudes being ordinarily assigned to the nearest half-unit). Assuming a special distribution-function already employed in the investigation of flood-statistics [10] makes it possible to choose a scale for a plot in which the points for various magnitudes fall nearly on a straight line, the level of which is an indication of the degree of activity. The method promises a quantitative definition of seismicity.

A recent large shock, not included in the studies referred to, occurred in the region of Borego Valley, San Diego County, on October 21, 1942. This was well recorded at all the regular stations in and near southern California, and numerous aftershocks were recorded with a portable instrument at temporary locations. Preliminary epicenter and origin-time for the main shock are: 32° 58′ north, 116° 00′ west; O = $16^h\ 22^m\ 14^s$, October 21, GCT. The magnitude was about 6.5. A large following shock had a very different epicenter: 33° 18′ north, 115° 41′ west; O = $01^h\ 50^m\ 38^s$, October 22, GCT; magnitude 5.8.

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