THE DEEP EARTHQUAKE

of the

CENTRAL PACIFIC

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by

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I. INTRODUCTION

A. The Present Status of the Study of Deep-Focus Earthquakes

So much has been written of late on the early history of deep focus earthquakes that is is scarcely necessary to treat the matter here. For example, Mr. Blum[1] traced the development of the study and enumerated the principal deep shocks that had been studied to date. Since the publication of his thesis, while much further work has been done on the study of the periodicity of such earthquakes, their cause, geological and other implications, possible correlations with shallow earthquakes, their geographical distribution, etc., not much as far as the writer is aware, has been done in the way of exhaustive studies of individual earthquakes from the original seismograms. The present trend, however, is toward such a method of investigation and from it we can most likely expect the future clarifying contributions to our knowledge of earth structure and the only real improvement in our travel-time tables and arrival-time curves.

Great impetus and practical aid will no doubt be given to such a line of research by the important papers[2]

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(1) Blum, V.J., S.J., "Seismometric Study of the Moderately Deep Earthquake of June 24, 1935." M.S. Thesis, St. Louis University, 1936, pp. 3-8.

(2) Gutenberg, B., and Richter, C.F., "Contribution to the Study of Deep Focus Earthquakes." Beit. z. Geophys. 41:160-166.
"Materials for the Study of Deep-Focus Earthquakes." Bull. Seis. Soc. of America, 26:341-390, 27:157-183.
"Depth and Geographic Distribution of Deep-Focus Earthquakes." Bull. Geol. Soc. of America, 49:249-288.

recently published by Gutenberg and Richter especially in connection with their papers on seismic waves(3). In as much as reference will be made to the first three of these papers and material has been taken from the second and third, a very brief outline of their content is here given.

"Contribution to the Study of Deep-Focus Earthquakes" deals with the modification required in the S-P method for determining origin time in the case of deep focus earthquakes, the determination of depth from pP-P and sP-P intervals, the determination of distance by a correction to be added to the S-P or P-O distance for a normal shock and finally the determination of both depth and distance by the P'P' phase.

In the first paper on "Materials for the Study of Deep-Focus Earthquakes" the authors refer to their papers on seismic waves in normal earthquakes and state, "Before one proceeds to the investigation of deep-focus shocks, certain fundamental data must be derived from the results found for normal earthquakes. This is the purpose of the present paper. The theoretical results can then be compared with the observations of deep-focus earthquakes." The authors consequently proceed to outline their method for calculating the travel-times for deep-focus earthquakes, tabulate the various corrections and in a group of tables(more than forty) give the calculated travel times for all principal seismic waves for focal depths of 100 to 800 km at intervals of

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(3) Gutenberg, B., and Richter, C.F., "On Seismic Waves." Beit. z. Geophys. 43:56-133, 45:280-360, 47:73-131.

100 km. This is indeed a contribution to the study of deep earthquakes and will likely serve almost as a text book of reference and comparison for years to come, in the hands of those who take up the investigation of individual shocks from the original seismograms. The authors themselves in the concluding part of their paper present a preliminary report on fourteen shocks selected for testing the data and methods proposed. While such a procedure does serve as a check, especially when the shocks have been previously studied in detail from the original seismograms as is the case with a few of those listed in Tables 52 and 53, nevertheless, it seems to this writer that the acid test will come only with the construction of tables and curves for principal phases, based on the data gathered from the original records and the comparison of these curves or tables with the calculated ones. Such a study has been made by Reverend Joseph Lynch, S.J., on S and SKS phases of the November 14, 1937 earthquake.

The second paper supplements the preceding one with a further treatment of methods for locating epicenters of deep shocks and calculations of times for pP, sS, sP and pS phases, and by the addition of several tables, notably one giving epicentral distance as a function of the travel time of P and of the focal depth. A comparison of the values obtained in the present study with those found in Table1[4] appears in Table VII

(4) Gutenberg, B., and Richter, C.F., "Materials for the Study of Deep-Focus Earthquakes." Bull. Seis. Soc. of Amer. 27:161-165.

and will be discussed in a later section.

It was with the thought that in addition to providing valuable data for the study of local structure, the investigation of the violent, deep earthquake of April 16, 1937, would yield observational results which could profitably be compared with the calculated data of these two papers.

The following is, as it were, but a preliminary report.