# A STUDY OF THE SEISMIC P WAVE IN THE SHADOW ZONE OF THE EARTH'S CORE

Otto William Nuttli, B.S. in
Petroleum Geophysics, M.S.

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# INTRODUCTION

Seismologists agree that the earth has a core which reflects and refracts elastic waves. However, the depth of the core and the nature of transition into the core are not as well agreed upon. As the principal sources of this information the investigator has available data concerning the time of arrival, amplitude, and period of the various body waves which travel to and through the core. The waves which have been used most frequently to determine the depth to the core are PcP and ScS, which are longitudinal and transverse waves, respectively, reflected from the core of the earth. However, there are two disadvantages in using these waves for such a determination. They are not the first waves to arrive during the passage of an earthquake, and thus they are recorded when the seismograph is in a state of agitation. As a result, there is some difficulty in accurately determining their time of arrival. In addition, these reflected core waves do not furnish any direct

information concerning the nature of the transition into the core.

There is an earthquake wave which is not subject to the above-mentioned limitations. It is the P wave, which is the first wave to arrive at a given station. At short and intermediate epicentral distances it travels directly through the mantle of the earth, taking the brachistochronic path. At distances greater than some critical value it travels from the focus to the core, which it strikes at grazing incidence, then along the core as a head wave, and finally back to the station on the surface of the earth. The slope of the travel time curve of P at these greater distances is a function of the depth to the core and the velocity of the P wave at the core discontinuity. Assuming a knowledge of this velocity, which may be obtained by a numerical integration of the earlier portion of the P curve, it is possible to compute the depth to the core.

Previous observations of the P wave at distances greater than that for which the P wave just grazes the earth's core have been very meager. However, recent improvements in seismic instrumentation, time control, and geographic distribution of stations indicated that it was possible to determine reliably

the arrival time of P at great distances.

At the suggestion of the Reverend James B. Macelwane, S.J. a study was undertaken to determine the travel time of the P wave at great distances. In addition, a study of the partition of amplitude and energy caused by elastic waves striking a spherical boundary was begun. It is hoped that this study may eventually lead to a complete knowledge of the partition of amplitude and energy of an elastic wave striking the core of the earth at grazing incidence.