NEW VALUES FOR SOME OF THE DISCONTINUITIES IN THE EARTH

The interior of the earth has been subject of interest from earliest times but it has remained for Seismology to afford the most direct means of investigating actual conditions in the earth beyond the reach of borings.

A severe earthquake sets up elastic waves which are transmitted throughout the earth and their behavior reveals the path over which they have travelled and something of the nature of that path. Thus we have come to a knowledge of the core of the earth and its overlying layers.

This investigation had its inception in a design to examine the shape of the core of the earth by means of elastic waves. Time did not permit the attainment of that object, but the development of the work has revealed new values for the depth of some of the discontinuities between the earth's surface and its core.

HISTORICAL SUMMARY

Legendre(1) was the first to formulate an equation to express the variation of density in the interior of the earth. It was empirical and based on the known density of the surface of the earth and that of the earth as a whole. He assumed that the greater density of the interior was due to simple pressure of the superimposed material. Roche(2) expressed the same law in a more convenient form. Poincare, Lipschitz,(3) Helmert,(4) Oekinghaus,(5) G. H. Darwin and other investigators, making the same assumption as Legendre, have formulated similar equations.

Another line of thought was initiated in 1840 when Hopkins(6) suggested that the interior of the earth is in a rigid condition, at least to a depth of one-fourth of the radius. Lord Kelvin called attention to the fact that the earth must be rigid in order that the force of attraction of the sun and moon may produce the tides. Darwin took up this idea and from tidal analysis found that the rigidity of the earth as a whole must exceed that of steel.

In 1897 Wiechert(7) advanced the hypothesis, based on astronomical and geophysical data, that the earth is constituted of an iron core and rock mantle. In 1906 Oldham(8) advanced the view, based on the behavior of transverse seismic waves, that the elastic properties of the earth undergo a change at a depth of about six-tenths of the radius, i. e., at about 3800 km., thus indicating the existence of a central nucleus and an outer shell. In 1906–1907, also from seismological data, Wiechert and Zoeppritz(9) confirmed this view of change of properties but they put the discontinuity at about 1500 km. deep. They further stated that the inner portion is composed, most probably, of iron, as this would satisfy the value for the density of the earth as a whole.

Using more accurate seismological data, Geiger and Gutenberg,(10) early in 1912, determined by the method of amplitudes, discontinuities at depths of 1194 km., 1677 km., and 2436 km. As a result of their study of the Columbian earthquake of January 31st 1906, Rudolph and Szirtes,(11) in 1912, located discontinuities at depths of 1592 km. and 3180 km. The latter figure was the greatest depth at which a discontinuity