CORE PHASES AND THE EARTH'S CORE

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A renewal of interest in the structure of the Earth's core, due in part to the considerable numbers of well-recorded PKP data made available by recent improvements in seismograph systems, has resulted in several recent reinterpretations of previous core models. It is the intent of this study to resolve inconsistencies in these new models and determine a representative core structure consistent with observations of longitudinal waves transmitted through the core.

Observations of P, PKP and pP are used to precisely determine the hypocentral parameters for two well-recorded deep-focus earthquakes and a near surface event. Arrival times and amplitudes of core phases from these events supplemented by recently published PKP observations form the basic data sample.

Theoretical travel-time curves for core phases routinely recorded on high-magnification seismograph systems are computed for several basic types of suggested core models. Insight is sought by plotting these curves with the new data described. Results

of this study reveal that a working model of the core consisting of a single-layer transition zone can explain observed data within reasonably close limits. This layer is between 400 and 600 km thick and has a P velocity distribution either constant or decreasing with depth. The top of the layer, defined by a discontinuous increase in velocity, has a radius greater than 1667 km but less than 1807 km. The bottom of the layer or inner core boundary, also defined by a velocity jump, is between 1233 and 1250 km in radius. Intermediate PKP arrivals in the distance range 140° to 160° can be ascribed to the distant end of the travel-time branch associated with this layer.

The phase PKKP is found to provide useful confirming evidence of structure indicated by PKP data. PKKP observations may also be an important source of new reliable estimates of outer core velocities. Due to an inordinate amount of scatter in observed travel times of PKPPKP it is unlikely that this phase can add any new information to that already obtained from other core phases.

Phases reflected up to four times within the core boundary are found to be routinely recorded

from large earthquakes. Energy contained in these phases is concentrated in a small bundle of rays near core-mantle grazing incidence. Examination of these data indicates that minor changes in outer core velocities may be necessary to account for certain arrivals not predicted by the present model. A core radius of 3473 km is not inconsistent with the new data.