CHAPTER VI

CONCLUSIONS

P waves generated from four nuclear explosions located in USA and USSR and three earthquake events from north Atlantic and south Pacific regions, have been used to construct $p - \Delta$ curves, P wave velocity and Q distributions with depth in the lower mantle of the Earth corresponding to $30^\circ - 90^\circ$ epicentral distances. Taking into consideration the limits of accuracy set by the procedure of collection of the data and simplifications of the methods of analysis, the following conclusions are drawn.

(i) There are some differences among the $p - \Delta$ profiles of each event. Except a minor difference in the Nov Zem profile, the agreements among the nuclear explosion profiles are good. On the otherhand, the NAR profile shows higher p values at small and large epicentral distances in comparison to the other two earthquake profiles. Between the two Rusian mainland explosions the W Kh profile shows faster arrivals at small epicentral distances than the E Kh event.

(ii) Although several anomaly regions have been indicated by the profiles, the most common among them are at 930 - 950 Km, 1530 - 1580 Km, 1850 - 1900 Km and 2470 - 2500 Km depths. A discontinuity level detected at about 1740 Km depth corresponding to 65° epicentral distance, in the Russian nuclear explosion profiles, seem to be mentioned by a very few workers.

(iii) Almost all the profiles, with minor exceptions, show a low velocity zone around 950 Km to about 1100 Km depth. A sharper velocity increase is observed beyond 1100 Km for all the profiles and a moderate increase beyond 1500 Km for S Nev, Fiji, Tonga and W Kh profiles. The Nov Zem profile, however, shows a sharp increase in velocity at 1200 - 1550 Km and a fall beyond 1900 Km depth with another sharp increase beyond 2550 Km depth.

(iv) A comparative study reveals a slow increase in velocity from 950 - 1100 Km followed by a slight jump. The rapid velocity increase becomes normal again beyond 1550 Km depth. Beyond 1900 and 2100 Km the rate of increase declines again.

(v) In the Pacific region higher velocity increase is observed below 1000 Km extending to the base of the mantle. Comparatively the velocity increase is slow in the upper part of the lower mantle in this region.

(vi) The average velocity V_p within 700 Km to 2720 Km depth can be expressed by a relation,

$$V_p = 8.3720 + .5120\times10^{-2}H - .2284\times10^{-5}H^2 + .4126\times10^{-9}H^3 .$$

where H is the depth from the surface of the Earth.

(vii) The general trend of Q - depth distribution is that, at first Q increases with depth and then falls towards the base of the mantle. The average Q for the uppermost layer of this study is found to be 210 and 190 for the lowermost. The low value of Q near the base of the mantle might be as a result of the apparent attenuation effect of the scattering of the seismic waves in that region.

(viii) The average Q - depth distribution shows high Q values from 1100 - 1500 Km depth followed by a low Q region from 1600 - 2000 Km.

Comparatively lower values of Q are observed in the Nov Zem profile. This is suspected to be due to some unknown source effect rather than a path effect.

(ix) There are general agreements between the velocity - depth and Q - depth profiles at high velocities associated with high Q and low velocity associated with low Q zones. However, in some profiles these values are slightly offset and a better correspondance is lacking. This might be due to the use of limited data and less rigorous methods.

(x) Both the Q and velocity distributions of P waves in this study suggest that the lower mantle is also heterogeneous, although, the magnitude of heterogeneity may not be comparable to that of the upper mantle.

(xi) Some of the results obtained in this study may change when azimuthal, station corrections etc. are applied to the data using more sophisticated techniques of inversion to a large volume of data.

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