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VII SUMMARY OF SPECIAL AND TECHNICAL REPORTS/ PAPERS PREPARED

VII.1 P-wave Velocities in the Upper Mantle beneath Fennoscandia and Western Russia

A detailed and extensive record section which has been constructed from recordings at NORSAR of presumed explosions in continental Russia exhibits two distinct (T,Δ) triplications. A particularly noteworthy feature of the (T,Δ) curves defined by the record section is the pronounced extension of the first-arrival branch for $\Delta \lesssim 21^{\circ}$ as a secondary arrival to a distance $\Delta \sim 33^{\circ}$. The reliable identification of these upper mantle travel-time branches has been possible because of the extremely dense, areal sampling of the NORSAR configuration.

The details of the P-wave multibranching offer powerful constraints on the nature of the upper mantle transition zone beneath the Baltic Shield and Russian platform. Notwithstanding the questions of uniqueness and baseline uncertainty, the following features appear to be demanded by the observational data:

1. A relatively small positive velocity gradient below the Moho to about 420 km depth
2. A relatively rapid increase in velocity by about 7% near 420 km depth
3. A relatively rapid increase in velocity by about 4% near 690 km depth
4. A relatively large positive gradient between the 'discontinuities' near 420 and 690 km depth.

A simple representative velocity model KCA has been derived which accounts adequately for all the principal features of the observational data. In the interests of simplicity, the model KCA includes first order discontinuities in preference to the depth-distributed discontinuities of comparable effect. The KCA model and the associated reduced (T,Δ) curves are shown in Fig. VII.1.1. It is apparent in this figure that the differences in the model and inferred observational

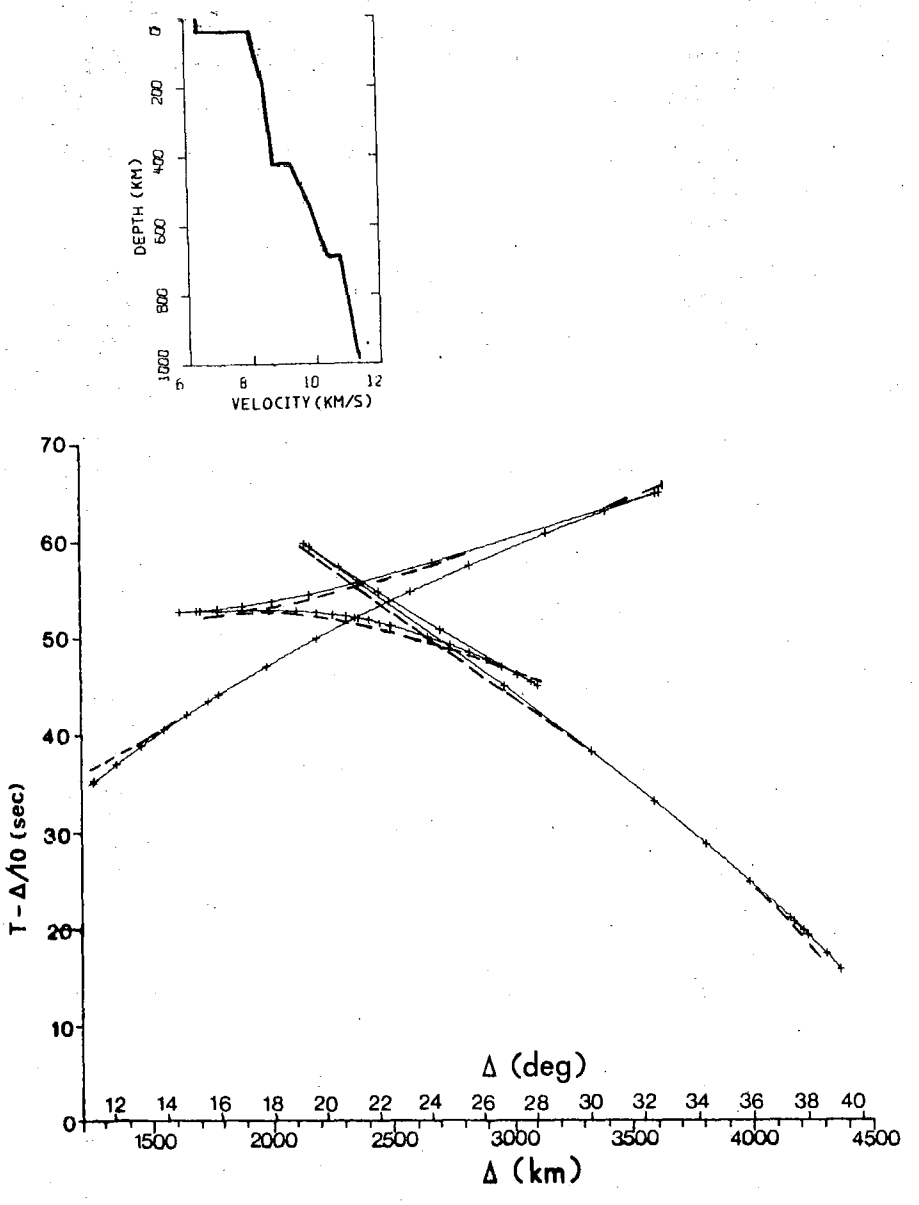

Fig. VII.1.1 P velocity model KCA, and corresponding reduced travel time-distance curves (full lines). Differences in the observed and model reduced times are shown by dashed lines. The spacing of the +'s on the model (T,Δ) curves is proportional to $d^2T/d\Delta^2$ and is indicative of relative amplitudes (considering geometrical spreading only).

(T,Δ) curves are minor. In addition, the KCA model is broadly consistent with observed relative amplitudes of the various branches, although in this respect the uncertainties are, of course, relatively large because of possible departures from perfect elasticity and other effects.

The discussion by Simpson et al (1974) on the implications of certain velocity models on the composition and state of the upper mantle is fully applicable with regard to the KCA model.

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REFERENCES

Simpson, D.W., R.F. Mereu and D.W. King (1974): An array study of P-wave velocities in the upper mantle transition zone beneath northeastern Australia, Bull. Seism. Soc. Am., 64, 6, 1751-1788.