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O. PRELIMINARY RAYLEIGH WAVE STUDIES NORTH OF SCANDINAVIA

Surface wave dispersion measurements taken to periods of the order of 100 sec or more have proved to be diagnostic of the properties of the upper mantle to depths of the order of about 0.5 λm for Rayleigh waves, where λm is the longest wave length.

The results obtained from great-circle passages are not representative of any particular ocean, shield or tectonic province. Instead they represent the averages of a variety of each of the three types of structural provinces (Dziewonski, 1971). Knopoff (1972) has described in detail the advantages of pure-path regional studies compared with "great circle decomposition" methods.

To overcome the difficulties of determining the initial phase of the source which is encountered in the single-station phase velocity measurements (Knopoff and Schwab, 1968) the two-station method is used. Under the assumption that the angle between the great-circle path between the earthquake and the stations on the one hand and the great-circle connecting the stations on the other hand is small (less than about 7°), the effect of the initial phase of the source is eliminated. The two-station method was first used by Brune and Dorman (1963) with peak-and-trough analysis and subsequently with machine Fourier analysis by Knopoff, Mueller and Pilout (1966).

To obtain phase velocities, the seismograms and the instrument responses of each station are digitized at a fixed interval of 2 sec, an interval sufficiently short to avoid aliasing problems for this study. The technique of Pilout and Knopoff (1964) and Knopoff et al (1966) for bandpass, digital filtering of detrended, digitized seismograms was applied to minimize the interference effects of multipath transmission. This procedure significantly improves the signal-to-noise ratio for complex records. The numerical window centered at the group arrival time is in the form of a half cycle of a sine function. Fourier analysis of each of the filtered seismograms gives the phases in the frequency band of the numerical filters. In Fig. O.1 an example is shown of the raw, filtered, and filtered-windowed time series.

For two stations on the same great-circle and recording the same event, the phase velocity at a given period T is given by

$$C(T) = \frac{D_2-D_1}{T[N+(\phi_2-\phi_1)]}$$

where D_2-D_1 is the station separation, $\phi_2-\phi_1$ is the difference in the phase shifts (in circle) between the two recordings, taking into account instrumental phase shifts; the arbitrary integer N is determined by making the phase velocity geophysically suitable at long periods and extending the phase continuously into the short period regime.

It should be noted that a systematic bias exists in the Love wave observations due to interference between fundamental and I higher mode in the range 30-90 secs. For this reason Rayleigh waves are more convenient for this type of study. Fundamental Rayleigh wave phase velocities were obtained with the previous technique for the path KBS-KRK shown in Fig. O.2, analyzing the event occurring at 06:26:15.8 the 28th of December 1967.

Unusually high values were found (Fig. O.3). They are compared with the values obtained by Noponen (1966) in Finland. The agreement between the two sets of data is good and we

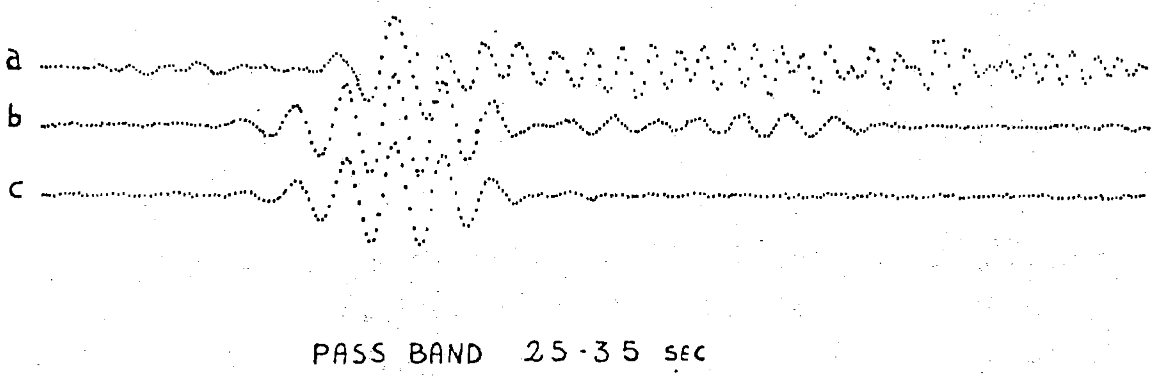

Fig. 0.1 Example of raw, filtered and filtered-windowed time series.

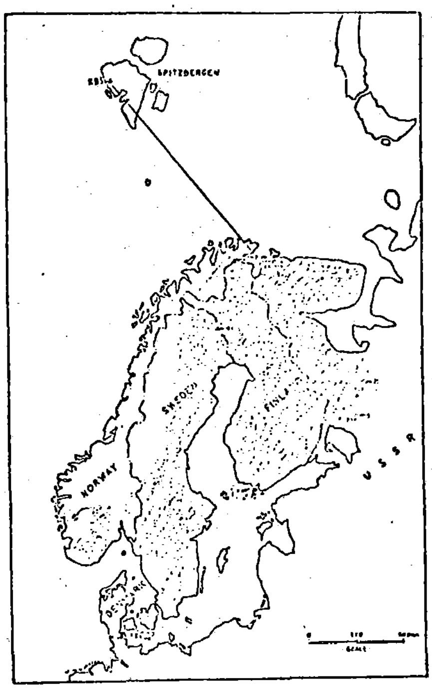

Fig. 0.2 Baltic shield and profile considered in this study.

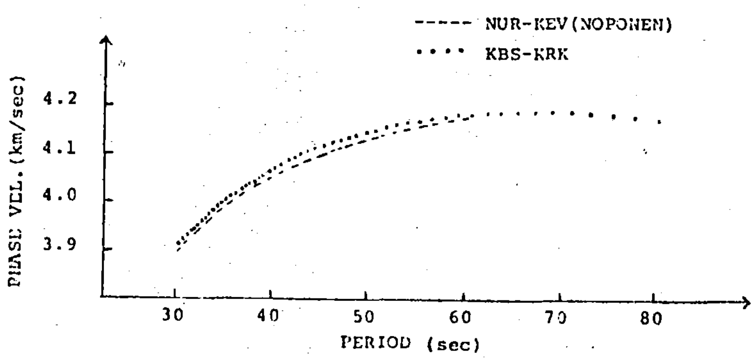

Fig. 0.3 Rayleigh wave phase velocity vs. period
experimental : dots
NUR-KEV (Noponen) : dashed line

may infer that the uppermost mantle is similar in the two regions.

Work is now in progress aimed at a more detailed interpretation of the experimental data.

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