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NORSAR

ROYAL NORWEGIAN COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

Scientific Report No. 6-73/74

SEMIANNUAL TECHNICAL REPORT
NORSAR PHASE 3

1 January – 30 June 1974

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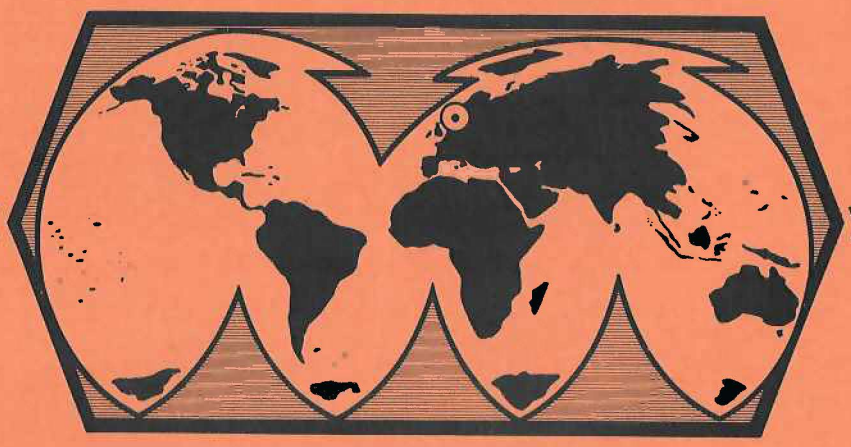
Kjeller, 1 September 1974



F. P CODA STUDIES

The irregular wave trains which follow well-known phases on short period seismograms represent meaningful information about the total seismic environment; Jeffreys (1962) has described the body wave coda as the greatest outstanding difficulty in the interpretation of seismic signals. Cleary and Haddon (1973) and Cleary, King and Haddon (1974) recently proposed an interpretation in terms of scattering by small-scale random irregularities in the crust and upper mantle which also account for the so-called precursors to PP reported by Bolt et al (1968) and several other workers. Coda wave trains recorded at NORSAR from distant events ($90^{\circ} \lesssim \Delta \lesssim 110^{\circ}$) are being analyzed in great detail in order to map approach directions (azimuth and slowness) of resolvable constituent energy bursts as a function of time. The data set of some 12 events exhibits great variability, and this in itself is evidence in support of a scattering-type interpretation.

Preliminary analysis results lend further weight to the scattering interpretation. In Figure F.1, the slowness of consecutive 15 second data windows from the coda of an event in the Molucca Passage is plotted as a function of arrival time relative to both P and PP. Also plotted is a theoretical curve for energy scattered or reflected asymmetrically at or near the free surface in the diametral plane through source and receiver. Jeffreys-Bullen tables were used in the construction of this curve, with details of large secondary arrivals taken from the model SMAK1 of Simpson, Mereu and King (1974). Notwithstanding the limitations of this 2-D representation, the measured slownesses (azimuths were all within $\pm 20^{\circ}$ of the P azimuth) are fully consistent with the scattering interpretation. It is also apparent from this figure that for this particular travel path (Philippines to Norway), the most energetic part of

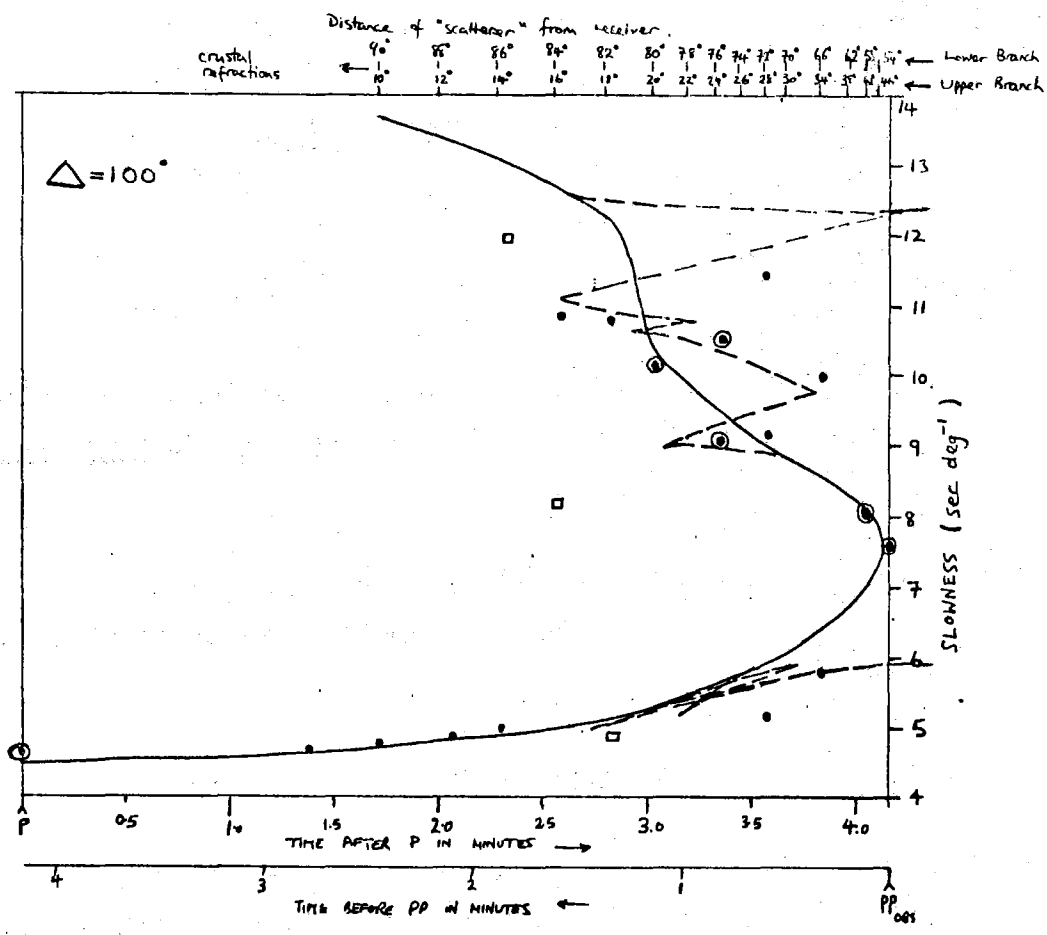


Figure F.1 Observed slowness values for 15 second windows from coda of an event in Malucca Passage ($\Delta \sim 100^{\circ}$) compared to theoretical minimum time curve. Theoretical curve drawn by eye through JB values, with details of triplications taken from Simpson et al (1974). Dots mark energy peaks, open squares significant subsidiary peaks. Dots within circles are peaks $\gtrsim$ 16 dB.

the coda is dominated by waves scattered in the vicinity of the Ural mountains ($\sim 20^{\circ}$ from NORSAR) and focused by the upper mantle velocity structure. Interestingly, the results presented by Cleary et al (1974) suggest that scattering in the vicinity of the Urals also dominates the coda of the Novaya Zemlya events recorded at Warramunga in Australia.

coda of the Novaya Zemlya events recorded at Warramunga in Australia.

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