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A Study of the Characteristics of Scattering Attenuation by Physical Modelling

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ABSTRACT

Scattering attenuation $(1/Q_s)$ depends not only on wave frequency but also on scatterer size. Using void holes as scatterers in a thin duralumin plate, and with the ka value (k is the wave number, a the scatterer radius) being changed systematically from 0.05 to 5, the fluctuation of direct waves between a homogeneous and a scattering medium are observed in order to calculate the scattering attenuation by 2-D physical model experiments. The experimental results show that $1/Q_s$ has a peak around ka = 0.5. At high frequency, $1/Q_s$ is proportional to $(ka)^{-1}$, whereas at low frequency the decay of $1/Q_s$ relative to $(ka)^4$ is steeper than predicted by Rayleigh scattering. The medium can be considered to be a quasi-homogeneous one, and the scattering effect can be neglected when ka < 0.05. The velocity fluctuation has a sharp change at ka = 0.5. The velocity of the scattering medium doesn't change when 0.5 < ka, is less than that in a homogeneous medium and exhibits a constant fluctuation when ka < 0.5. Whether the wave length is smaller or greater than the scatterer size, the P- and S-waves have the same scattering attenuation coefficients if they have the same ka value.

(Key words: Scattering attenuation, Intrinsic attenuation, Physical model)

1. INTRODUCTION

Absorption of seismic energy while propagating in a medium is a result of two major factors. The first factor is the intrinsic attenuation $(1/Q_i)$ due to the transfer of seismic energy to heat caused by friction. The second factor is the result of scattering attenuation $(1/Q_s)$ whereby seismic waves are scattered by the heterogeneity of the media. In this case, the scattered energy isn't absorbed but merely redistributed in space and time. The intrinsic attenuation is less complicated than the scattering attenuation because the latter depends not only on the frequency but also on the scatterer size. Nevertheless, field surveys often involve some kind of combination effect of these two factors (Frankel, 1991; Mayeda *et al.*, 1991;

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