AN INVESTIGATION OF BODY WAVE VELOCITIES, ATTENUATION AND ELASTIC PARAMETERS OF ROCKS SUBJECTED TO PRESSURE AT ROOM TEMPERATURE

by

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In investigating the Earth's crust as a whole, as a gigantic spherical shell undergoing deformation through the effect of natural forces, the properties of the rocks must be known. It is of interest, therefore, to simulate the pressure conditions of the crust in the laboratory, in an attempt to learn more about the rock properties.

Mechanical properties of rocks are known to vary with pressure. Their body wave velocities and attenuation are closely related to density, granular texture, mineralogical composition and geologic history.

The interpretation of the dynamic parameters of seismic waves in rocks is impossible without the prior knowledge of the attenuation of rocks under various physical conditions.

In this study, the velocity of compressional and shear waves and the attenuation of these waves is studied in eight rocks. A hydrostatic pressure of up to 500 bars and an axial pressure of up to 1500 bars were applied. The compressional and shear wave velocities were found in all cases to increase with pressure. The density was also found to increase appreciably, in

all rocks, in the lower ranges of the pressure.

Static Young's modulus and Poisson's ratio were calculated using strain gages and the values were compared with those determined dynamically. Dynamic methods were found to be more suitable for measuring Young's modulus, while both static and dynamic values gave the same degree of accuracy for Poisson's ratio in the range of the pressures tested.

The attenuation of compressional and shear waves was investigated under both axial and hydrostatic pressure in the frequency range of 40-200 kHz. The compressional wave attenuation in most cases was found to decrease with increasing pressure; shear wave attenuation followed a more or less similar pattern, and it was many times higher in magnitude than that of the compressional wave. Since the pressure is seen to reduce the attenuation, a frictional mechanism depending on the movement of one surface past another may be responsible for the attenuation in the rocks.