VELOCITY OF COMPRESSIONAL WAVES IN POROUS MEDIA AT PERMAFROST TEMPERATURES

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(Abstract)[1]

Measurements of velocity of compressional waves in consolidated porous media, conducted within a temperature range of 26°C to -36°C, indicate that: (1) compressional wave velocity in water-saturated rocks increases with decreasing temperature whereas it is nearly independent of temperature in dry rocks; (2) the shapes of the velocity versus temperature curves are functions of lithology, pore structure, and the nature of the interstitial fluids. As a saturated rock sample is cooled below 0°C, the liquid in pore spaces with smaller surface-to-volume ratios (larger pores) begins to freeze and the liquid salinity controls the freezing process. As the temperature is decreased further, a point is reached where the surface-to-volume ratio in the remaining pore spaces is large enough to affect the freezing process, which is completed at the cryohydric temperature of the salts-water system. In the ice-liquid-rock matrix system, present during freezing, a three-phase, time-average equation may be used to estimate the compressional wave velocities. Below the cryohydric temperature, elastic wave propagation takes place in a solid-solid system consisting of ice and rock matrix. In this frozen state, the compressional wave velocity remains constant, has its maximum value, and may be estimated through use of the two-phase time-average equation. Limited field data for compressional wave velocities in permafrost indicate that pore spaces in permafrost contain not only liquid and ice, but also gas. Therefore, before attempting to make velocity estimates through the time-average equations, the natures and percentages of pore saturants should be investigated.

Reference Added By Author After Presentation of Paper

1. Timur, A. Apparatus For Studying Ultrasonic Wave Propagation In Rock Samples Under Axial Pressure at Permafrost Temperatures. Rock Mechanics and Engineering Geology, Vol. 6, No. 4, 1968.

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