

Developed Correlations Between Porosity, Permeability and Sound Wave Velocity at Different Compaction Pressures for Sandstone Core Samples

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In the evaluation of a petroleum reserve, it is necessary to determine accurately certain petrophysical properties such as porosity and permeability of the reservoir rocks under different compaction conditions. These properties are affected by the relevant physical properties and such physical properties and also mechanical properties affect the drilling programs and the development plans for a reservoir. It is more convenient to use homogenous rock samples with nearly constant initial permeability, obtaining such cores is very difficult. In this paper a simulated natural and homogeneous compacted sandstone rock with known physical and petrophysical properties were used. The physical properties include grain size, cementing material concentration, and compaction (confining) pressure. The effect of these properties on the petrophysical properties of Rock such as permeability and

porosity were also known. For the same simulated natural sandstone rocks, Sound wave velocity was measured using an ultra sound tool. Good relationships have been developed between sound wave velocity and other rock properties; porosity, permeability, cementing condition at different confining pressures. The sandstone cores have been grouped according grain size to five groups ranged between 45 and 300 μm mixed with different concentrations of cementing material. The mixture was compacted at three different compaction pressure ranges from 11000 to 23000 psi. These varying lithification factors gave these sandstone rocks a wide range of petrophysical and physical properties. The results of this study were presented as graphs of simulated lithification factors, porosity, and permeability versus sound wave velocity.