OVERPRESSURE PREDICTION THROUGH POROSITY ESTIMATION IN SEDIMENTARY FORMATIONS USING GEOPHYSICAL WELL LOGS IN THE SOUTH-WESTERN PART OF THE NIGER DELTA BASIN OF NIGERIA

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ABSTRACT

Gamma-ray and Sonic-log data from nine petroleum wells in South-Western Niger Delta were used to determine porosity values for sandstone and shale beds in an attempt to predict over pressured zones, establish surface porosities and compaction trends so as to deduce compaction factors for the lithology, investigate the relationship between transit time/velocity, and hydrocarbon prospects in the basin. Gamma ray log was used to delineate the lithologies while Sonic log was used to predict overpressure and to compute acoustic transit times, velocities and porosities of the formation. The results showed that porosity decreases linearly with depth in normal compacted formations, but increases with depth in an over pressured zone for both sandstone and shale beds. In well XA-1 at depths (3671m; 13% and 3695m; 15%) and (3639m; 14% and 3680m; 16%) for sandstone and shale beds respectively. Velocity increases with depth in normal compacted formations while it decreases with an increasing depth in over pressured zones. In normal compaction sandstone porosity (13%) is less than shale porosity (15%) at the same depth (3700m) while in over pressured zones sandstone porosity (28%) is higher than shale porosity (26%) at the same depth (4000m) in well XA-1. Sandstone porosity (42.02%) is greater than shale porosity (38.73%) at the earth's surface. The average compaction factors for both sandstone and shale beds are 0.0071 and 0.0050 respectively. The result of this study can be useful in the evaluation of oil reservoir, overpressure prediction and sedimentary basin analysis.

KEYWORDS: Gamma Ray, Lithology, Overpressure, Porosity, Sandstone, Shale and Sonic Log, Transit Time, Velocity