COMPARATIVE PETROPHYSICAL STUDY OF RESERVOIR SANDSTONES IN THE "U", "K" AND "N" FIELDS, SOUTH-EAST OF THE NIGER DELTA.

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ABSTRACT

The study identified, correlated and petrophysically evaluated sandstone reservoirs in the "U", "K" and "N" fields situated in the southeastern part of the Niger Delta with a view to identifying common traits that could be used for predicting reservoir quality and thus enhance hydrocarbon recovery.

Digital well log data of eight wells from the Niger Delta were analyzed and interpreted using the flow chart for log interpretation as a guide and the 7.6 version of the SMT Kingdom Suite software as a tool. Graphic plots and charts were used to determine and to illustrate the variability of some petrophysical properties (porosity, shale volume, grain size, bulk volume water and relative permeability). In calculating the compaction coefficient and percentage compaction of the sandstones, the Athy and Einsele decompaction equations were used.

Sandstones of good reservoir quality were identified in "U", "K" and "N" fields; 19 for the "K" field, one for the "N" field, and two for the "U" field. The reservoirs in the "K" field varied in texture from very fine to coarse grained while those in "N" and "U" fields were fine-grained. A total gas-in-place of about 18.30 million cubic feet and optimal oil-in-place of about 7.39 million barrels were estimated for the "K" field. Values of moveable hydrocarbon index (< 0.7), moveable hydrocarbon saturation (high) and residual hydrocarbon saturation (very low) showed that the hydrocarbons had moved. The sandstones in the study area had percentage compaction values of 29.74 — 47.62 % and compaction coefficient values ranging from 0.0003 — 0.0005 m^{-1} (0.00009 — 0.0002 ft^{-1}). The studied wells did not penetrate the overpressure zones. A model compaction equation expressed as $Ø_{Av}$ = 0.0028Z + 46.55 (for depth in feet) or $Ø_{Av}$= 0.00084Z + 46.55 (for depth in meters) (where porosity, $Ø_{Av}$ is in percent and depth, Z, is in feet or meters) was subsequently derived for porosity prediction in the hydrostatically pressured sandstones. Effective porosity values for the reservoirs ranged from 18.0 — 38.0 %, and showed

a general decrease with depth. The sand beds showed good correlation within fields and were fairly correlatable across fields.

In conclusion, the sandstones of the three fields showed good reservoir qualities but differed in their hydrocarbon saturations. The "K" field appeared to be more of gas field than an oil field.