APPLICATION OF SEISMIC ATTRIBUTES TO RESERVOIR EVALUATION OVER "X" FIELD, NIGER DELTA, NIGERIA

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ABSTRACT

The aims of this study on the "X" field in Niger Delta were to identify faults and other subsurface structures, to identify and evaluate the tops and bottoms of sand reservoirs and to correlate seismic attributes with reservoir properties determined from well logs. The study also aimed at investigating the petrophysical characteristics of the reservoirs and at generating time and depth structure maps of the study area. These were done to unravel the subsurface geology and hydrocarbon prospect of the study area.

The data used for this study included, Migrated 3-D Seismic section [dip and strike], field check shot-survey, composite well logs and base map of "X" Field sourced from Chevron Nigeria Limited (CNL). The Kingdom Suite Software version 7.6 licensed to Department of Geology, Obafemi Awolowo University, lle-lfe. was used for the interpretation of the data and also for detailed fault mapping and correlation of six wells. Gamma-Ray (GR) and Spontaneous Potential (SP) logs were used to identify sand/ shale sequence. Shallow laterolog (LLS) and deep laterolog (LLD) were used to identify the occurrence of hydrocarbons. Neutron and Compensated Formation Density logs were used to define hydrocarbon type present. The identified hydrocarbon-bearing zones G500 and J400 sands were mapped on the seismic section using time-depth data. Time, depth structure and velocity maps were generated for the interpreted events. Selected computed diagnostic seismic attributes and petrophysical characteristics were analysed.

The time and depth structure maps revealed that the dominant trapping mechanism in "X" Field was the growth fault generated rollover anticlines which trend northwest-southeast and northeast-southwest of the downthrown side of the main structure building fault F2. The attribute displays showed that the anomaly was directly on the structural closures, thus

supporting the interpretation made from the seismic and well log data. Petrophysical values obtained showed that the identified sands had porosity of 23 % in well-01, 18 % in well-03, 20 % in TMB-04, 50 % in TMB-05 and 26 % in TMB-06. Water saturation values (SWA) of 62 % were obtained in TMB-01, 93 % in well-03, 53 % in TMB-04, 65 % in TMB-05 and 98 % in TMB-06 and permeability values obtained were in 1.2 Darcy range. The Oil-In-Place (OOIP) in G500 sand was 391,369,882,209 barrels (502,319,971,914.6 M^3) and 2,555 680,724.8 barrels (3,280,194,842.98 M^3) in J400 sand. Similarly, Gas-In-Place (OGIP) was 2,458,565,805,694 barrels (3,155,548,656,199.72 M^3) in G500 sand and 16,0546,57,047.0 barrels (20, 6060, 18,091.16 M^3) for J400 sand.

In conclusion, Seismic attributes analysis could be used to predict reservoir rock properties, delineate reservoir bodies in a low net-to-gross ratio formation, which led to optimally selected drilling location of wells. Seismic attributes analysis was found to be cost effective and greatly improved reserve estimates. There was a high probability that new locations identified within the seismic grid in "X" Field were viable prospects.