DETAILED SUBSURFACE STRUCTURAL AND STRATIGRAPHIC INTERPRETATION OF KUNBI MARGINAL OIL FIELD, NIGER DELTA, USING THREE DIMENSIONAL (3-D) SEISMIC REFLECTION DATA

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A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A DOCTOR OF PHYLOSOPHY (PH.D.) DEGREE IN APPLIED GEOPHYSICS OF THE DEPARTMENT OF GEOLOGY, FACULTY OF SCIENCE OBAFEMI AWOLOWO UNIVERSITY, IFE

2007

ABSTRACT

The primary objective of this study was to determine the proven, probable and possible oil reserves in the supposedly marginal Kunbi Field as a means of establishing if the oil accumulation in the field is in commercial quantity.

The methodology involved the integration of seismic 3-D structural and stratigraphic time interpretation; seismic attributes like reflection intensity, root means square amplitude and complex trace attributes like instantaneous amplitude, instantaneous frequency and phase to maximize information derivation from the field. Depth mapping was integrated with detailed petrophysical analysis to build a static model with constant petrophysical parameters which were used to calculate the reserves. Post well completion nuclear logging using Haliburton's Reservoir Monitoring Tool was conducted to re-establish oil contacts by measuring carbon-oxygen ratio and other elemental yields. Stratamplitude and complex trace attributes were extracted from the interpreted seismic to infer the field's depositional environments and facies. The gamma ray log characteristic shapes were also used in conjunction with reflection geometry and high resolution biostratigraphic studies to completely detail the sequence stratigraphic setting and depositional environment of the field; classify the reservoirs according to sedimentation stacking processes. The interpreted 3-D seismic time maps were then converted to depth maps using the average velocity method while a detailed petrophysical analysis was then integrated with the depth maps to build a static model which was used to calculate the original oil in place and ultimate recoverable reserves.

The result of the analysis of stratamp in Excel showed that even though the reservoirs were optimally located structurally at all the eight oil bearing levels, some of them were not optimally located stratigraphic wise and require some lateral shifts from 35 meters up to 247 meters. Integration of seismic reflection geometry, logs' shapes interpretation and Stratamplitude study confirmed that the reservoirs in this depocenter were of shallow marine, deltaic, river mouth siliciclastic sand bars, fluviatile derived, transported and deposited under moderate to high energy regime and wave dominated. The result of the

static modelling and the resulting reserves calculation revealed that Kunbi Field proven, probable and possible reserves were in excess of 99.5, 162.4 and 272.2 MMBL STOIIP prior to nuclear logging with Haliburton's Nuclear Reservoir Monitoring Tool compared with the previous estimation of proven reserves of 56.9 MMBL STOIIP using the 2-D seismic data. However, post completion nuclear logging suggested that the probable (P1+P2) reserves can be as high as 256 MMBOL as compared with 162 MMBOL STOIP above.

It was concluded that in addition to the proved, probable and possible oil reserves in this field, there were other drillable updip and upside oil potentials within the farmout polygon.