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# Evaluation of seismic and petrophysical parameters for hydrocarbon prospecting of G-field, Niger Delta, Nigeria

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## Abstract

Adequate analyses of seismic and petrophysical data help to minimize drilling risk and maximize well and reservoir productivity. Reservoir characterization was carried out to provide information and improve understanding of the geological and petrophysical parameters, and hence improve decision making regarding the development of the field under study. Wireline logs obtained from three wells as well as a 3D Seismic data coverage of G-field in the Niger Delta were evaluated using the petrel software. Suites of gamma and deep resistivity logs aided the delineation and correlation of the sandstone unit, while the top was tied to the seismic data using synthetic seismogram to determine seismic characters. Well correlation enabled the delineation of reservoir sand across the wells. The quality of the reservoir was determined from petrophysical averages, in which the reservoir has an average thickness of 72 m, average porosity of 0.31, average net to gross of 0.75, average Vshale of 0.25, and average water saturation of 0.19, respectively. Listric normal faults were mapped across the field. The models reveal lateral and horizontal variations in reservoir properties which capture subsurface heterogeneity and anisotropy across the reservoir sand, and also possible sweet-spot zones were identified. These are diagnostic of areas for future exploitation and recovery of hydrocarbon. Seismic attributes analysis was done to predict variation in lithofacies across the sandstone body.



## Introduction

Many dry holes have been drilled in the Niger Delta as a result of inaccurate analysis of the integrity of the numerous fault-dependent closures and stratigraphic setting associated with the basin. The Niger Delta like many deltaic areas is extremely difficult to define due to the heterogeneous nature of the various sedimentary lithofacies units associated with it. This complex physical property of the basin has made it extremely difficult to define formations and their interfaces. And so integration of 3D seismic and well data for structural interpretation and reservoir characterization is a continuous process of providing an improved understanding of the geological and petrophysical controls of fluid flows in the reservoir. It encompasses all methods and techniques that can lead to a well-improved understanding and a much better handling of the reservoir. Reservoir characterization is defined as a systematic means of quantitatively determining and assigning reservoir properties, establishing geologic information and uncertainty in spatial variability (Lake and Carroll 1986). Subsurface configurations must be well understood in order to be able to efficiently delineate the structures that are favorable for the accumulation of hydrocarbon; and several geologic parameters are important accumulation, gas and oil in large quantities, to form a pool sufficient enough for production. These parameters include good source rock (an organic-rich) to produce the oil or gas, a reservoir rock with sufficient porosity to accommodate the hydrocarbon, and good structural framework to prevent the oil and gas from leaking away (Coffen 1984). The importance of data integration is usually in improvement in the accuracy of mapping complicated structural plays (Adejobi and Olayinka 1997). When 3D

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