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Evaluation of Reservoir Connectivity of Gimboa Field, Deepwater West Africa

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Abstract

The detection and evaluation of reservoir connectivity and compartmentalization continues to be a significant issue in reservoir characterization, especially in offshore fields that must commit significant upfront costs before production can begin.

It is generally accepted that with most of the petrophysical and formation testing measurements made in the borehole we are able to detect reservoir separation but we are not able to prove connectivity. That is, we can prove the negative but not the positive. However, compartmentalization (proving the negative) can economically doom a project. Therefore it is incumbent upon the practitioner to incorporate and integrate all measurements, including logs, pressure measurements and PVT data, before passing judgment.

In the example discussed in this paper, multiple wells are being drilled as injectors. Connectivity to the producer wells is critical. We evaluate acquired pressures and gradients from formation tester tools in several of these wells. Additionally PVT quality samples were obtained and PVT data from these samples is incorporated intothe analaysis. Compartmentalization within a reservoir can be either vertical, lateral, or both. Evaluation of vertical connectivity can be done by either evaluating pressure or fluid discontinuities. The use of pressure discontinuities is well established. To use fluid discontinuities we assume that fluids in flow communication over geologic time will equilibrate to a predictable fluid gradient. Fluid distributions that are not predictable can be suspected to be not in flow communication and further investigation is warranted.

For lateral connectivity, we evaluate well-to-well data. Formation pressures and samples were obtained from the producer and the injector well. We show how to calibrate the response between different tools in different wells and then describe how the differences can be resolved. Again a statistical analysis of the pressure gradient data is applied to ensure that any inferences made are sustainable given the accuracy, resolution, and repeatability of the acquired data.

Introduction

Block 4 is located at the southern margin of the lower Congo Basin. The area is characterized by detached Cretaceous rafts gliding on a continuous bed of salt, divided by thick Tertiary sedimentary grabens which indicate salt movements until the present day. The Gimboa field is located in the middle part of the continental slope in an area with numerous turbiditic events which occurred during the Miocene period. A general geological cross-section showing the stratigraphy in the area is presented in Fig. 1.

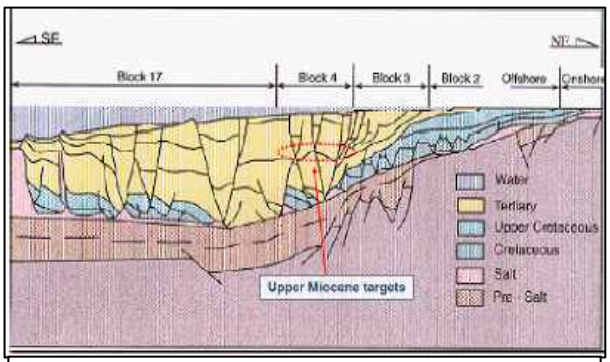

Figure 1 – General Geological Cross Section

The reservoir consists of unconsolidated sands of Upper Miocene age. Two different reservoir facies were identified in the discovery well which we refer to as Well A: a younger frontal splay within a fan system (Upper Reservoir) in the northwest of the