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Mature Offshore Fields Rejuvenation via Long Reach Wells and Massive Hydraulic Fracturing: The Kitina Case History

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Abstract

Many West Africa Offshore Fields are maturing and operators are completing secondary targets in their wells to maintain the economic operation of their valuable assets. However, the capital expenditure associated to this kind of interventions of critical importance. It follows that the selection of the right and most remunerative well activities is crucial.

In the Kitina Field, offshore from Pointe Noire, Congo, deeper sands have been produced to economic depletion and reservoir studies allowed the determination of alternative production intervals for production maintenance. Large quantities of reserves can be found in low permeability, consolidated, formations as well as in very deep and remote culminations.

From March 2007 to June 2007, the Kitina field production increased of 80% reaching a production level lost since early 2004. This was achieved by infilling the Kitina South culmination with the long reach and ultra deep well KTM-SM5 and via a massive multistage hydraulic fracturing campaign carried out on the three wells draining the low permeability 3A reservoir. These represented the first applications in Congo of such technology. Eight hydraulic propped fractures were placed in three re-completed, cased-hole wells in the with very encouraging production improvements. A stabilized production increase ranging from 2 to 3 times was achieved.

The paper describes the unique reservoir modeling, operation geology, and drilling, completion and production challenges encountered in the 2007 Kitina successful rejuvenation campaign. In particular, it focuses on the successful multi-stage hydraulic fracture campaign carried out on four wells of the Kitina 3A reservoir from the preliminary design and production forecast pre-job to the reservoir model history match and forecast phase post-job.

Introduction

The Kitina Marine, Congolese offshore field, has been discovered through the exploration well KTNM-1 in 1991. Two appraisal wells were drilled later on which confirmed the discovery. The field's production starts up took place in December 14th 1997 via 13 wells (8 oil producers and 5 potentially water injectors).

The Kitina field is composed by the following 5 levels:

- 3A – limestone, sandstone with silty clay
- 2A – Limestone: Oolitic Grainstone/Packstone, bioclastic with good intergranular porosity and intercalation of sandstone with carbonate cement.
- 2A South Culmination: Oolitic Grainstone/Packstone, bioclastic with good intergranular porosity and intercalation of sandstone with carbonate cement.
- 1A - Sandstone with carbonate cement and limestone.
- 1B – Sandstone with carbonate cement and limestone