Use of APSDM and EM_PreSS Inversion to Impact Evaluation of a West Africa Deepwater Discovery

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This paper discusses the impact of APSDM and EM_PreSS inversion technology on the evaluation of an ExxonMobil operated West Africa deepwater field. The trap was defined as a distributary channel complex (DCC) on the flank of a faulted anticline. The hydrocarbon gas bearing sands have a class III AVO response whereas oil sands have a class III or II AVO response. An exploration well (Well 1) and its side track discovered multiple oil reservoirs in Miocene sands. Using pre-stack time migrated (PSTM) data, dual fluid contacts were observed for multiple reservoirs in several fault blocks. In general, oil-water-contacts (OWCs) interpreted on the PSTM data conform better to the depth structure maps than the gas-oil-contacts (GOCs) which are inconsistent across the fault blocks.

After the Well 1 discovery, Esso and the co-ventures began development planning. To plan the appraisal wells smartly, and to reduce drilling costs, an anisotropic pre-stack depth migration (APSDM) was applied over the field. The seismic amplitude maps extracted from the APSDM showed well-defined OWCs in all fault blocks but the GOCs seemed inconsistent.

One of the primary appraisal objectives was to predict and confirm a gas cap presence in each of the fault blocks for possible gas injection. ExxonMobil proprietary EM_PreSS inversion processing was applied to the APSDM near and far offset data. The EM_PreSS inversion process reshapes the original seismic spectrum to make it similar to the average impedance log spectrum. The observations on the EM_PreSS inversion data increased confidence in predicting that Well 2 would penetrate gas in the original hole and oil in the sidetrack. The well successfully encountered gas in the original hole and oil in the sidetrack, thus confirming the pre-drill fluid prediction.

The good agreement between predictions made on the EM_PreSS inversion volumes and the well results convinced Esso and the co-ventures to extrapolate the results and learnings from the penetrated fault block to other fault blocks without drilling more appraisal wells. Use of the APSDM and EM_PreSS inversion favorably impacted business decisions during field appraisal and development planning