Pre-drill Fluid Type Discrimination using AVO Analysis: Case Study of a Deepwater Reservoir, Western Niger Delta

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Pre-drill fluid type discrimination constitutes one of the main challenges in deepwater exploration and development. It is essential for evaluating hydrocarbon resource potential and guiding drilling programs. AVO analysis is a technique for analysing prestack seismic data for amplitude versus offset anomalies that are related to anomalous Poisson's ratio contrasts. We applied this technique to predict fluid type in a reservoir comprised of Miocene turbidite amalgamated channels in the western Niger delta. The channels are located in a water depth of 1300 meters and drape over the westernflank of a diapir, with trapping provided by stratigraphic and structural components. The only well penetration in the reservoir encountered gas over oil. However, the hydrocarbon type and its extension below the identified gas-oil contact (GOC) is uncertain despite the presence of seismic
amplitude anomalies which suggest the presence of hydrocarbons. A perched oil, gas over heavy oil, or non connected accumulations have been proposed as different scenarii to explain the fluid content in the reservoir.

Local AVO responses were identified and calibrated against a background response or water trend deduced for water bearing reservoirs encountered by wells in the study area. Anomalous AVO behaviour on crossplots of Near and Far seismic responses from the reservoir were interpreted in terms of probable fluid scenario. The AVO analysis suggests the presence of gas downdip of the GOC, with an oil rim (perched oil) as the most likely fluid scenario. This finding is supported by amplitude breaks on amplitude versus time (AVT) plots, depth-conforming seismic amplitude shutoffs, and pressure (MDT) data from the single well penetration and offset wells. In similar settings where fluid type is unknown, this technique would be useful in extrapolating fluid type interpretation away from wells.