Identifying a Bypassed Reservoir in Limestone a Sequence with Magnetic Resonance While Drilling

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Abstract

Petroamazonas EP is the national oil company in Ecuador. It holds most of the oil concessions in the country. As most Ecuadorian operators, they have a common primary formation-producing target present across the country called "Hollin". The need to expand the oil reserves have driven most oil companies, Petroamazonas included, to evaluate some secondary objectives including carbonate sequences believed to contain hydrocarbons.

The interests in better evaluate the carbonate sequence with a tool able to reflect formation permeability led to a trial run with the Logging While Drilling (LWD) Nuclear Magnetic Resonance (NMR) tool. The choice for LWD was based on the difficult logging conditions (large, heterogeneous interval in a 12 ¼" section) for a conventional cable log. The drilling of this section is a challenge by itself concerning bit and mud selection for covering the whole interval, let alone having good conditions for logging. The LWD tool's static magnetic field geometry was optimized to provide reliable measurements in the hostile LWD environment and to have negligible interference on well-survey instrumentation. For the selected well, COCA K-40 the Bore Hole Assembly (BHA) prioritized quality by placing a 12" stabilizer above the tool to guarantee centralization and minimum lateral motion.

This first run proved to be very valuable providing complementary information to better characterize the secondary objectives. All the expected sands and carbonates were evaluated for lithology independent porosity, permeability and grain distribution. The carbonate section presented very poor porosities and almost no movable fluids, however at the base of formation "Caliza A" a good quality sand body was identified by the MR which was not clearly seen on the triple combo and was not counted on by the geological sequence. It presented very good permeability but low resistivity due to a large glauconitic presence. This makes it a potential producer discovery.

Nuclear Magnetic Resonance added precision to rock quality characterization and can identify whether or not the carbonate sequence presents any producible zones in a reliable way. This would allow having solid information to invest in testing those newly identified zones.