

Ecuador

## CHALLENGES

- Resolve uncertainty about fluid types and contacts, and determine pressure connectivity between different reservoir zones
- Understand formation pressures and mobilities for production and completion design in highly deviated well

## SOLUTION

- Implemented a pressure test acquisition program for gradient analysis, along with resistivity, neutron, and density logs for enhanced reservoir understanding
- Conducted formation testing while drilling for real-time acquisition in a high-angle well in a single run

## RESULTS

- Collected all 20 requested pressure points to cover the reservoir's phases and stratigraphic components
- Delivered full petrophysical analysis and pressure testing
- Performed real-time reservoir characterization with gradient analysis for pressures, mobilities, fluid typing, contacts, and reservoir compartmentalization

# Formation pressure testing service improves reservoir knowledge, reduces rig time

First GeoTap® IDS formation pressure testing service provides key information to understand reservoir compartmentalization in deviated well

## Overview

An operator in Ecuador devised a strategy to drill wells in an unexplored area of a reservoir to enhance production and potential reserves. They identified a compartmentalized reservoir. This discovery made hydraulic characterization of the production interval crucial to their plans. For one well, the approach involved a trajectory with high inclination along the reservoir interval.

## Challenges

After drilling two wells in an unexplored area of the field, the operator needed to establish mobility, determine fluid contact location, and create connectivity between geological units in the reservoir for the third well. The future well plan included a reservoir target at a high angle. This increases risk and rig time associated with pressure test data acquisition.

## Solution

Halliburton recommended a pressure test data acquisition solution on the logging while drilling (LWD) bottom hole assembly (BHA) to acquire the necessary data and help minimize risk. The quad-combination BHA, GeoTap® IDS pressure testing, and fluid identification and sampling service was designed to estimate fluid mobility. This combination also helped calculate pressure gradients to determine the reservoir phase with the measurement of formation pressure and petrophysical evaluation in a single run.

## Results

All 20 pressure points requested by the operator were measured. The scope spanned the entire reservoir and its various phases and stratigraphic components. Zones of high pressure and mobility were identified in the main reservoir body. Two phases were identified as water and oil based on the gradient analysis. The stratigraphic bodies above the main reservoir – targets in previous wells had low pressure, mobility and permeability values. This correlates with results obtained from quad-combo curves acquired through a detailed petrophysics analysis.

## Pressure test acquisition with LWD solution

Pressure test data acquisition with wireline would have been a technical challenge and added cost for the operator because of the requirements of the high-angle well trajectory section that crosses a reservoir. Halliburton proposed a quad-combo package that included the GeoTap® IDS service and iCruise® intelligent rotary steerable system (RSS). This proposal was designed to help the operator achieve the formation evaluation requirements and deliver information crucial to the reservoir development plans. Because this was the first run with GeoTap® IDS service in the country, pre-job planning was vital to deliver outstanding service. The collaboration with the operator included multiple meetings between the drilling, geology, and reservoir teams, and Halliburton to support directional drilling and logging feasibility. These meetings also covered BHA engineering, simulations, risk assessment, offset analysis, and formation test procedures.

A total of 20 pressure test points were acquired in a single run. This approach addressed the operator's requirements. The geology and reservoir teams received valuable information from pressure test results, such as reservoir gradient and compartmentalization interpretation.

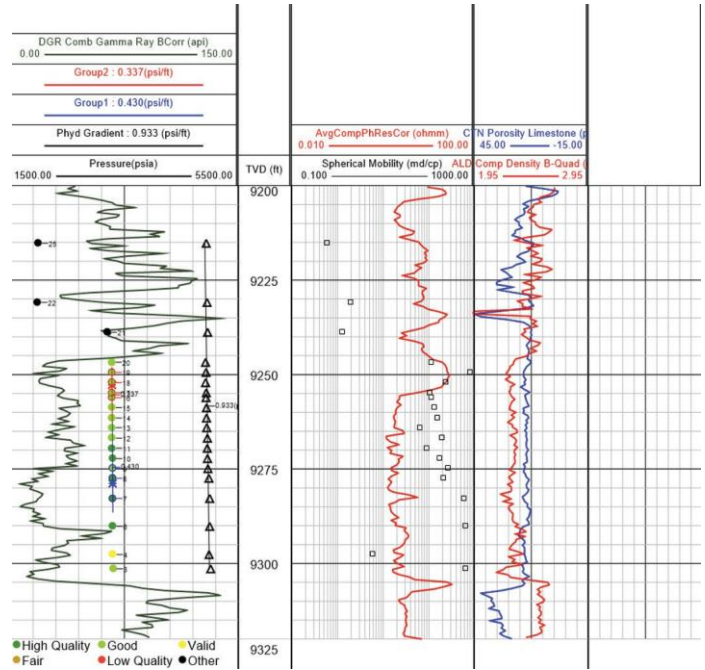


Figure 1 - Pressure gradients in two zones.

**Drilled to target and executed pressure test plan**

The team achieved a high directional drilling index (DDI) well trajectory to target total depth with the use of a complex quad-combo BHA that included GeoTap® IDS service and the iCruise® intelligent RSS. They performed 20 pressure test points in a single run and acquired two pressure gradient zones without any HSE or SQ incidents.

**Pressure test samples provided reservoir insight**

Results from pressure tests allowed the operator to enhance the target reservoir understanding and make real-time decisions about current operations and subsequent completion plans.

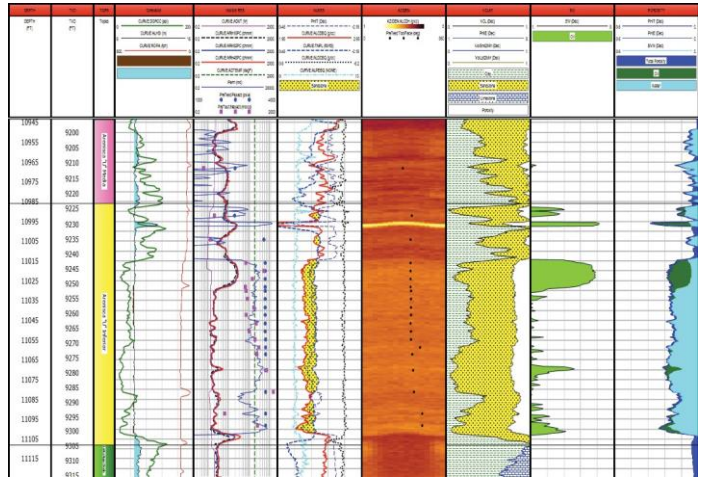


Figure 2 - Formation evaluation information acquired with quad-combo LWD BHA that included GeoTap® IDS service.

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