

Real-Time Fluid Identification Enabled Data-Driven Decision Making by Operator During Reservoir Appraisal Campaign

SUCCESSFUL GEOTAP® IDS FLUID IDENTIFICATION AND SAMPLING SERVICE RUN IN HIGH-DIRECTIONAL DRILLING INDEX (DDI) AND LONG STEP-OUT WELL TRAJECTORY

MALAYSIA, SOUTHEAST ASIA

OVERVIEW

An international oil and gas company in Malaysia developed a strategic plan to drill two oil producer wells to encourage future oil exploitation endeavors within the acreage. This reservoir has been producing for some time, and uncertainties existed regarding fluid contact and total hydrocarbon in-place. Therefore, pressure gradients and fluid identification pump-outs were necessary at various reservoir intervals.

The in-field development plan for this oil field involved a well trajectory with a high DDI and a long step-out to tap into the distal targets from the platform surface location.

CHALLENGES

- Improve reservoir understanding by performing formation pressure gradient analysis and fluid sampling in shallow 661-m TVD kick-off with 3°/30 m DLS; maintain a long 75° inclination tangent before dropping to 45° inclination to TD
- Hole cleaning in the high-angle, long, step-out tangent section is prone to cutting avalanches and potential stuck pipe

SOLUTION

- Design a quad-combo BHA using GeoTap® IDS fluid identification and sampling service and Geo-Pilot RSS BHA
- Provide 24/7 advanced drilling optimization from Halliburton Sperry Drilling's Eastern Hemisphere Drilling Engineering Solution (EHDES) Hub

RESULTS

- Drilled to planned well TD and achieved directional plan with maximum 4.02°/30 m DLS in the shallow build section
- Performed 36 pad settings using GeoTap IDS service for pre-test pressure points, five instances of pressure gradient analysis, and pump-out for fluid identification
- Achieved 2.5 hours stationary and pumped 55 L of fluid for fluid identification with zero stuck pipe incidents
- Successfully executed plan with no hole cleaning issues nor immediate intervention necessary to prevent pack off incidents in 6.343-DDI well trajectory

RESERVOIR FLUID SAMPLING SOLUTION

Because of the high inclination angle and the relatively long step-out of the tangent section, acquiring wireline pressure test points and sampling would have been challenging using costly options, such as pipe-conveyed methods or deploying a tractor to pull through to well TD.

Thus, a quad-combo LWD package combining GeoTap® IDS fluid identification and sampling service and a Geo-Pilot RSS BHA was proposed to help achieve the operator’s formation evaluation requirements and tap into a relatively shallow drilling target to obtain positive identification of the reservoir fluid type.

Pre-job planning was key to understanding the operator’s challenges. Collaboration with the operator involved multiple teams working with a global solutions engineering staff for directional drilling and logging feasibility, BHA engineering, simulations, risk assessment, offset analysis, and formation sampling while drilling (FSWD) on-paper sessions.

Five pressure gradients were acquired in two runs, identifying water (Figure 1), oil, and gas.

A pump-out station (Figure 2) was also performed where water was successfully confirmed in real time.

DRILLED TO TARGET AND EXECUTED FSWD PLAN

The team successfully delivered a high-DDI well trajectory to target TD with a long complex quad-combo FSWD RSS BHA, performed 36 pressure pre-test points in two runs, acquiring five pressure gradient zones with water, oil, and gas. Additionally, a 2.5-hour pump-out for fluid identification was performed.

FLUID IDENTIFICATION PROVIDED RESERVOIR INSIGHT

The positive identification of the fluid type using GeoTap IDS service in this multiple sand target reservoir enhanced the operator’s understanding of the reservoir and allowed real-time decisions to be made regarding current operations and subsequent drilling plans.

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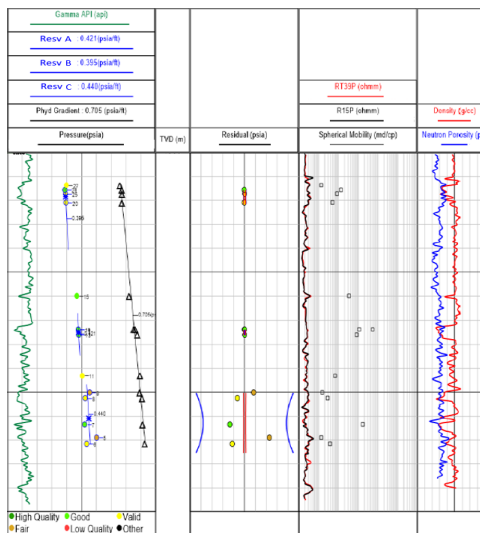


Figure 1—Water pressure gradients in three zones.

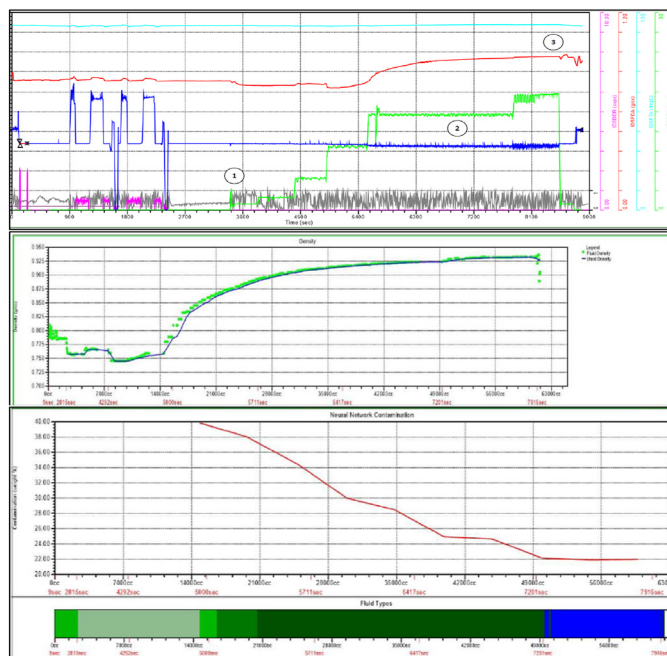


Figure 2—Water pump-out station where fluid was successfully identified. Contamination at the stop point was estimated at approximately 20%.



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