ENABLING THE UNDERSTANDING OF RESERVOIR FLUIDS PROPERTIES WHILE DRILLING

By: Schlumberger

The unique ability to fully understand reservoir fluid properties during drilling operations creates new possibilities in well placement and reservoir characterisation, while reducing costs. The Schlumberger SpectraSphere® fluid mapping-while-drilling service, recently introduced at the OTC in Houston, delivers these advantages in multiple environments—from enabling advanced knowledge of untapped reservoirs in exploration to derisking fluid analysis and sampling in highly deviated development wells.

The applications of the new services are far-reaching: from reservoir fluid characterisation and identification of compartments and lateral sealing boundaries to enhanced geosteering and well placement and formation testing in extended-reach drilling and deepwater operations.

The main benefits that the technology has proven to bring to the operators include:

- facilitation of early reservoir development decisions and production optimisation;
- improvement of reservoir understanding through deep insight into fluid composition and distribution;
- enablement of productivity steering in development wells;
- mitigation of risk in challenging environments due to reduced footprint on the wellbore; and
- savings of operating costs by streamlining well construction and reducing flat time.

By taking accurate pressure measurements and analyzing fluids while drilling, the SpectraSphere service enables real-time decisions that help improve geosteering outcomes, guide wells to the ideal trajectory, and access more reserves. (Image courtesy of Schlumberger)
weight to be adjusted according to data to minimise differential sticking risks.

Schlumberger performed 16 pretests to obtain formation pressure and to estimate mobility prior to fluid analysis or sampling. Two initial pretests were taken in the gas zone to optimise the mud weight for the section, which verified that no adjustment was needed. The mobility measured during the pretests also enabled the identification of the optimal location for the first pumpout station. The operator initiated DFA operations at the target depth. Although the BHA had been on station for nearly three hours, it was successfully moved and no significant overpull was observed, despite the known high sticking conditions in this section of the reservoir.

The new technology has been field-tested in Africa, Malaysia, the Gulf of Mexico and the North Sea. In all cases, subsequent laboratory tests of field samples confirmed the accuracy of the real-time fluid mapping results, providing assurance that laboratory sampling can, in many cases, be eliminated.

*Mark of Schlumberger

**Technology Overview**

The SpectraSphere service comprises three modules: pretest probe, fluid mapping and sample carrier. The pretest probe module delivers accurate measurements of formation pressure and mobility to determine the best location in the reservoir to analyse the fluid.

Once at the select location in the reservoir, the downhole fluid analyser—as a part of the fluid mapping module—uses spectrometer data obtained from the visible and near-infrared spectrum. Data are used from fluid composition analysis while drilling. The sample carrier module then acquires up to 12 pressure/volume/temperature-grade fluid samples.

In exploration, the new fluid mapping-while-drilling service helps operators gain an early understanding of untapped reservoir potential and reduce exploration costs by acquiring laboratory-quality samples while drilling. In the appraisal and development phase, which can include highly deviated or extended-reach wells, the new service ensures optimal positioning of wells to mitigate wellbore risks, enable better completions, and, ultimately, more production from the field.

**Successful Application in Middle East**

An operator working in the Middle East planned to drill a multilateral horizontal oil well to help assess the field’s continued production potential. The operator sought to verify the presence of movable hydrocarbon into the 4- to 6-mD/cP section of the reservoir, confirming its production potential, and strive to overcome high-stick/slip conditions.

Schlumberger recommended using the SpectraSphere service in combination with the EcoScope* multifunction logging-while-drilling service, providing an opportunity for the first fluid mapping-while-drilling operation in the Middle East. Deployment would be in the 21 1/2-cm (8 1/2-in) section and would enable measuring formation pressure and evaluating fluid properties while drilling. The proposal included several pretests that, to obtain formation pressure, would provide a mobility estimate prior to fluid analysis and sampling. It would also enable the mud weight to be adjusted according to data to minimise differential sticking risks.

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