Evaluation of Advanced, Multiphase PLT Data Validates Fractured Granite Basement Prospect

Expert analysis and interpretation demonstrates commercial potential of unconventional oil play in mature offshore basin

**CHALLENGE**
Evaluate the commercial potential of fractured basement reservoir zones in a rough, openhole environment damaging to conventional production logging tools (PLTs).

**SOLUTION**
Provide expert processing, analysis, and interpretation of data from advanced, multiphase production logging and integrate with openhole logs.

**RESULTS**
Quantified flow contributions from two faulted intervals despite hole conditions. Confirmed commercial viability. Established productivity beyond initial target zones.

"I am delighted with this operation. We have confirmed that our strategy to deploy sequential testing is highly effective. Test results are particularly enlightening as they confirm the basement reservoir is not only saturated with mobile oil but is also productive outside of the target reservoir fault zones."

Chief Executive Officer
Independent Operator

Targeting significant untapped hydrocarbon potential
Historically, oil companies stopped drilling when they encountered granite basement rocks. Even when natural fractures were known to contain hydrocarbons, such reservoirs were not considered economical to produce. Recently, interest in fractured basements has risen due to successes in Yemen, offshore Vietnam, and elsewhere. Commercial volumes of oil have been found in granite formations in 30 countries, some in mature regions with otherwise declining production.

To access the significant untapped potential of fractured basement reservoirs in an offshore basin, an independent operator developed a geological model to target prospective areas. The first well targeted two seismic-scale fractures, encountering the zone of interest at a 55° deviation.

Unlike conventional sandstone, storage and flow in a typical granite formation is controlled by fractures, not by porosity and permeability of the rock matrix. Thus, traditional image and sonic logs may not definitively evaluate fractured basement prospects. Understanding this, the operator decided to reverse the usual logging sequence and run a PLT before acquiring openhole well logs. If PLT results confirmed the reservoir could produce oil, further logging would ensue.

Expert processing, analysis, and a rush interpretation
As part of its suite of Fractured Basement Reservoir Characterization services, technical specialists with Schlumberger provided the operator with real-time support, logging program optimization, expert processing, analysis, and a rush interpretation of two sophisticated production logging surveys in the well using the Flow Scanner® horizontal and deviated well production logging system.

Since fractured basement reservoirs are completed openhole (casing is unnecessary in such hard rock), potential hole size variations present a mechanically challenging environment for normal PLTs. Designed to run inside smooth casing, conventional probes are often damaged or lost in rough, openhole granite formations. Also, if the hole is deviated—as it is in this case—recirculation can prevent single-spinner tools from reliably detecting or quantifying fluid entries.

Fractured Basement Reservoirs Around the World

In response to growing interest in fractured basement reservoirs worldwide, Schlumberger offers Fractured Basement Reservoir Characterization solutions, including expert analysis and interpretation of Flow Scanner multiphase PLT data.
After consultation with the operator, Schlumberger recommended running the Flow Scanner production logging system for high-angle and horizontal wellbores. Multiple spinners and holdup probes provided built-in redundancy in case of damage from an uneven borehole, while ensuring accurate hydrocarbon detection in case of fluid recirculation due to well deviation.

This operation was the first time Schlumberger deployed this solution in a fractured granite basement reservoir anywhere in the world.

**Confirming commercial potential, validating the prospect**

Despite challenging hole conditions, both surveys were successful, yielding a dynamic, high-quality dataset.

The first evaluated the shallower of two seismic-scale fracture zones. Interpretation of Flow Scanner data showed that multiple small fractures within the 400-ft interval contributed to flow. The second DST combined flow contributions from both fractured zones and the intervening formation. There was no evidence of depletion during either test. Also, extended pressure transient testing under shut-in conditions proved there was connectivity between the fracture zones and the larger reservoir.

Discovery of oil-saturated granite basement validated the operator’s geological model and confirmed the commercial potential of its first prospect in this mature basin.

Once it was evident the reservoir could produce oil, Schlumberger acquired a full set of openhole logs. Schlumberger experts analyzed and integrated all the data and created a mechanical earth model to further assist the operator in understanding reservoir properties, stress states, fracture geometries, production and depletion behavior, and volumetrics.