RCX successfully sampled extra-heavy oil in unconsolidated sands

A major offshore operator in China’s Bohai Bay was facing a field sampling challenge in a highly unconsolidated formation with extra heavy-oil distribution. Traditionally, formations such as those found in Bohai Bay have posed serious obstacles to wireline formation testing and sampling operations, including sand influx issues and probe seal loss.

The Reservoir Characterization eXplorer™ (RCX™) service from Baker Hughes, a GE company (BHGE), was able to provide the required samples, with the heaviest recorded oil viscosity ever sampled by BHGE.

Although the RCX service has a strong track record in collecting highly viscous samples in unconsolidated formations, sampling this extra-heavy oil in a friable clastic reservoir with mobilities ranging from 4.6 to 16.1 mD/cP presented a new challenge.

A customized operational procedure was developed using the RCX service configured with a large-face probe and the BHGE SampleView™ service to analyze the downhole fluids in real-time. The procedure incorporated an oil sampling technique known as selective slug sampling, which involved multiple opening and closing cycles of the downhole sample tank to ensure selective (oil) slugs were progressively collected. Controlled pumpouts assisted the faster breakthrough and increased fraction of oil while maintaining the single-phase condition of the sampled fluids by optimizing the pressure drawdown. This procedure also minimized matrix stress that can cause sand influx from the unconsolidated formations.

These special techniques allowed the BHGE wireline team to collect eight high-quality samples from two depth stations after pumping out 34 liters in 22 hours. Laboratory analysis of pressure/volume/temperature (PVT) properties confirmed 8° API extra-heavy oil with a viscosity of 48,201 cP at surface conditions.

**Challenges**
- High-viscosity, extra-heavy oil samples required in a low-mobility reservoir
- Shallow, unconsolidated clastic formation added risk of sand production and probe seal loss

**Results**
- Pure hydrocarbon samples were collected using the unique slug sampling technique while the water cut from the water-based mud (WBM) was 40-70%
- Minimized sampling time and potential operational issues
- Samples confirmed 8° API extra-heavy oil with a viscosity of 48,210 cP at surface conditions
The unique selective slug sampling capabilities of the RCX service enabled a pure hydrocarbon sample with minimized sampling time and reduced potential operational issues while the water cut was still between 40-70%.

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Sampled 8° API oil with a viscosity of 48,210 cP at surface conditions.