ExxonMobil Maps Complex Injectite Reservoir to Effectively Geosteer into Target Sands, North Sea

The GeoSphere reservoir mapping-while-drilling service enabled the operator to eliminate the need for pilot holes and improve landing success in the Balder field.

**CHALLENGE**

Distinguish targeted sands from nontargeted sands when drilling through a complex formation to land effectively and optimize production while eliminating the need for costly pilot holes.

**SOLUTION**

- Use the GeoSphere* reservoir mapping-while-drilling service to map the targeted massive sands before landing the 12¼-in section.
- Deploy resistivity at the bit via the geoVISION* imaging-while-drilling service to set the 12¼-in section at TD after drilling less than 10-m [33-ft] MD into the massive sands.
- Map the oil column to optimize geosteering and well placement in the 8½-in section, maximizing future production.

**RESULTS**

- Mapped the top of the massive sands from more than 20-m [66-ft] TVD above, ensuring a safer and more optimal landing result.
- Detected the oil/water contact (OWC) while landing the 12¼-in section prior to penetrating the reservoir.

**Eliminate need for pilot holes in development campaign**

As part of its drilling campaign in the North Sea Balder field—underway since 2013—ExxonMobil sought solutions that would eliminate the need for costly pilot holes in development wells. Due to the nature of the injectite sand reservoir, the operator found that pilot holes often failed to provide sufficient information to help land the producer wells. Moreover, pilot holes are associated with their own drilling challenges and costs.

The operator also experienced challenges related to accurately landing wells in the injectite reservoir’s massive sands instead of in thin injectite sills or dikes. Because of the heavy mud weight used for drilling shale in the landing section, ExxonMobil limited drilling into the massive sands to less than 10-m MD to avoid losses. Drilling was complicated further by the fact that the thin injectite sills or dikes found above the massive sands look just like these sands on conventional LWD logs. ExxonMobil wanted to avoid setting the casing point in the thin injectite sands because that can lead to drilling and wellbore stability issues in the shale between the casing shoe and the massive sands.

**Map complex lithology to distinguish sands**

To address these challenges, ExxonMobil selected the GeoSphere service to land the producer wells without pilot holes. With a depth of investigation of more than 30-m [100-ft] TVD from the wellbore, the service enabled the operator to detect the top of the main reservoir from more than 20-m TVD away. In addition, the GeoSphere service also successfully mapped the OWC before the top of reservoir was penetrated. All of this information was acquired in real time while drilling the 12¼-in section of the producer wells.

The ultradeep measurements provided via the GeoSphere service enabled ExxonMobil to identify whether the sands entered by the well were thin injectite sands or massive sands based on their unique signatures on the service’s inversion canvas. By landing and setting the 9¾-in casing in the massive sands, the operator reduced drilling and completions risks by casing off unstable shale above the main reservoir.
Maximize production with optimized well placement

For ExxonMobil, optimal placement of the wellbore was critical to ensure maximum production. To geosteer effectively, the operator needed to overcome constraints such as standoff from the OWC, gas/oil contact, or both, as well as the uneven and changing nature of the top of the massive sands. The GeoSphere service was used to track the OWC and determine the lowest-acceptable TVD during reservoir geosteering. The accurate mapping of the roof of the massive sands enabled ExxonMobil to make informed decisions regarding changes to the well path, staying close to, but still avoiding, the roof.

The reservoir geometry mapped by the GeoSphere service, in combination with seismic interpretation, enabled ExxonMobil geoscientists to plan the geosteering strategy ahead of the bit. Production from the wells drilled with the GeoSphere service in this drilling campaign significantly boosted production from the field. Oil production in 2015 increased 37% compared with 2012, the year before the campaign began.

GeoSphere service outputs for the landing and reservoir sections of a producer well in the Balder field drilling campaign. During landing, the thin injectite sands were identified and the top of the massive sands was detected at 21-m [69-ft] TVD away. Throughout the reservoir section, the entire oil column—from the top of the reservoir to the OWC—was mapped and the well path was geosteered to maximize production.