**CASE STUDY**

**Most Productive Zones of Niobrara Formation Targeted After Expert Log and Real-Time Data Interpretation**

Petrotechnical evaluation helped identify key technologies to characterize, drill, and evaluate unconventional reservoir, Colorado

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**CHALLENGE**
Determine key production drivers in the Niobrara formation, target the interval of highest reservoir quality, and accurately geosteer the horizontal lateral within that zone.

**SOLUTION**
Engage Schlumberger petrotechnical experts to recommend and run a suite of fit-for-purpose tools to characterize the reservoir, guide real-time geosteering, and optimize completions.

**RESULTS**
Identified the 10-ft [3-m] interval of greatest production potential, stayed in zone for the entire 3,000-ft [914-m] lateral length, and modified completion design to maximize well performance.

"The Schlumberger petrotechnical team was very easy to work with and provided the expert guidance needed to successfully complete our first three horizontal wells within the desired stratigraphic interval."

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**Optimizing characterization to maximize productivity**
A small operator in the Denver-Julesberg basin of Colorado began its first horizontal drilling campaign in the Niobrara formation, an unconventional oil reservoir with four laterally continuous chalk units. Based on historical drilling data, the operator knew the “B” unit was the primary target in this area but did not know what portion of the 36-ft [11-m] zone would be most productive.

The operator needed to understand the reservoir’s major production drivers—petrophysics, mechanical properties, natural fractures, structural complexity, and so on—and use that knowledge to optimize drilling and completions not only for the first well but also for the entire campaign.

Since the company’s internal resources were limited, and because it was relatively unfamiliar with the area, the operator wanted to shorten the typical learning curve associated with entering any new unconventional play.

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**Reservoir Characterization**

**Petrophysical Evaluation**

**Borehole Imagery**

**Acoustic Properties**

Expert analysis of high-tier log measurements determined that a 10-ft interval (yellow) in the Niobrara “B” (green) was the zone of greatest production potential.
Accurately quantifying key production drivers

The customer approached Schlumberger because of its experience consulting on unconventional projects in the Denver-Julesberg basin. Schlumberger petrotechnical experts recommended acquiring high-tier, fit-for-purpose logging measurements for the pilot hole and a geosteering solution for the lateral.

A suite of equipment, including the Platform Express* integrated wireline logging tool, ECS* elemental capture spectroscopy sonde, and the CMR combinable magnetic resonance tool accurately quantified mineralogy, porosity, permeability, and saturation. Borehole images from the FMI* fullbore formation microimager helped identify natural and induced fractures, and acoustic behavior information from the Sonic Scanner* acoustic scanning platform characterized the Niobrara formation’s stress state and other mechanical properties.

Expert processing, analysis, interpretation, and integration of field log data by Schlumberger geoscientists and engineers yielded a better understanding of the target reservoir in the area. In the process, they identified a 10-ft [3-m] interval in the middle of the Niobrara B unit as the zone of greatest potential. After determining where to drill the horizontal lateral, the team’s next challenge was to keep the wellbore within that more-productive zone as much as possible.

Targeting the productive zone, optimizing completions

Because of the formation’s extensive lateral continuity, Schlumberger recommended its new MicroScope* resistivity- and imaging-while-drilling service to guide geosteering operations. A Schlumberger well placement engineer interpreted resistivity images in real time to construct an initial cross-section of the target interval and to determine when the borehole was climbing or dropping. As a result, the well successfully remained in the zone of highest reservoir quality for more than 3,000 ft [914 m].

After drilling was completed, further processing and interpretation of high-resolution MicroScope imagery revealed detailed bedding and fracture intensity as well as the strike and dip of open and healed natural fractures. This information allowed the structural section along the well path to be refined, which enabled the engineers to optimize the original completion design by

- combining similar lithologies
- avoiding the placement of packers in areas of intense fracturing
- managing fluids and pump rates to prevent excessive leakoff and achieve near-wellbore connectivity.

The results from this initial well enabled the operator to make more-informed decisions about additional wells in its ongoing Niobrara drilling program.

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