PetroChina Changqing Increases Initial Well Production Three-Fold in the Ordos Basin

Mangrove completion and design workflow optimizes fracture placement and fracture surface area with 50% less fracturing fluid

**CHALLENGE**
Increase oil recovery in tight sand reservoirs by using horizontal drilling techniques, improving fracture placement, and enhancing fracture surface area.

**SOLUTION**
Use Mangrove* software to build a 3D reservoir model and simulate complex fractures based on interactions between hydraulic fractures and natural fissures.

**RESULTS**
- Realized 3.6 and 4.4 times higher initial production in two pilot wells than in conventional vertical wells
- Increased 3-month production 50% more than in best offset horizontal well
- Reduced reservoir-to-wellbore pressure drawdown 50%
- Stimulated desired surface area with approximately half the fracturing fluid of the original design

“Initial production tests for these two pilot wells show 3.6 and 4.4 times higher production with half the reservoir-to-wellbore pressure drawdown of vertical wells on the same pad.”

Xu Yong Gao
Deputy Chief Engineer, PetroChina Changqing

Tight wells required advanced completion and fracturing techniques
China’s Ordos basin, the second-largest sedimentary basin in the country, has proven reserves estimated at 10 billion tons. Historically, field development has been economical, but due to low permeability, many of the wells have had low yields. To increase recovery, PetroChina Changqing partnered with Schlumberger to increase effective fracture surface area, optimize fracture placement, and apply horizontal drilling techniques in two wells

**PetroChina Changqing used fracture simulation and monitoring services to optimize stimulation treatments**
Schlumberger recommended the unconventional 3D fracturing design workflow within Mangrove software to help optimize completion and fracturing designs—without replacing the existing multistage fracturing tool. The team built a 3D reservoir model from log correlations and interpretations, as well as seismic and reservoir studies.

From there, the unconventional fracture model simulated complex fractures based on fracture-induced stress shadows and interactions between hydraulic and natural fissures. PetroChina Changqing and Schlumberger selected optimal fracture placements based on reservoir and completion quality. StimMAP LIVE* microseismic monitoring service helped engineers optimize fracture placement and fracture surface area during each stage of the treatment.

In this case, the Mangrove 3D reservoir model was built from well log correlations (left). Curved surfaces and zones were extracted to capture detailed formation variation from well to well (right).
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The Mangrove software’s 3D unconventional fracture model visualizes the interactions between hydraulic fractures and natural fissures. Based on microseismic monitoring, the natural fissures models (left) and reservoir model (right) are calibrated between every stage. This calibration helped PetroChina Changqing achieve the desired surface area with only 50% of the designed fracturing fluids.

**Operator realized 50% higher sustained production than previous-best horizontal well**

"Initial production tests for these two pilot wells show 4.4 and 3.6 times higher production with half the reservoir-to-wellbore pressure drawdown of vertical wells on the same pad,” said Xu Yong Gao, Deputy Chief Engineer, PetroChina Changqing.

After 3 months, the horizontal wells optimized with Mangrove software showed 50% higher stablized production rates than the previous-best offset well. PetroChina Changqing identified the completion workflow as a key to the campaign’s success—from both production and operational standpoints. The success of these jobs led PetroChina Changqing to use the pilot wells as a template for future tight oil development in the Ordos basin.