Completions Optimized with Integrated Geomechanical Approach

Integrated geomechanical and petrophysical analysis of core data helps increase production by 500 Mcf/d

**CHALLENGE**
Determine most effective stimulation treatment and avoid previous costly mistakes.

**SOLUTION**
Evaluate formation using TerraTek* rock mechanics and core analysis services.

**RESULTS**
Achieved better stimulation treatments and more economic completions, with an increase in production of 500 Mcf/d.

**Reservoir evaluation disrupts fractured completion trend**
Fracture growth out of the zone, potentially into water zones, had delayed and damaged multiple completion opportunities for an operator in the Barnett Shale. To determine the most effective stimulation treatment for the completion of this complex reservoir, the formation evaluation would need to be multifaceted and include thorough geomechanical and petrophysical properties determination with downhole scanning tools. The evaluation goals were threefold: examine petrophysical data to determine reservoir quality; analyze geomechanical properties of the formation through a detailed core analysis; and combine the petrophysical evaluation, the

Cluster analysis with anisotropic mechanical prediction.
CASE STUDY: Integrated geomechanical approach increases gas production by 500 Mcf/d

comparison between log-derived and core-measured geomechanical properties, fluid-sensitivity tests, and offset well data to make the best recommendation for completion.

**Anisotropic stress model delivers fracture success**

Schlumberger used TerraTek services to perform an evaluation of this Barnett Shale reservoir. Analysis gave the operator a detailed evaluation of this formation and a completion methodology designed for success. The completion methodology, designed for perforation placement avoiding laminated intervals, focused on more siliceous layers with low-closure stress. To avoid fracturing down into the water zone below the shale, analysis suggested perforating in intervals to promote upward growth.

With the analysis providing a full understanding of the reservoir, the operator incorporated a tapered proppant mesh throughout the course of the hydraulic fracture treatments. Key components of the evaluation methodology included the use of ECS* elemental capture spectroscopy sonde, FMI* fullbore formation microimager, ELANPlus* software, Sonic Scanner* acoustic scanning platform, Platform Express* wireline logging tool, and TerraTek core analysis to provide a complete characterization of the reservoir and its potential.

Processing mechanical properties with an anisotropic stress model is critical to predicting and mitigating proppant entry issues, as well as predicting fracture geometry. A thorough knowledge of the stress gradient and contrasts is vital to determining the optimum way to hydraulically fracture the reservoir. Detailed fluid sensitivity tests lead to the selection of the best fracturing fluids.

**Complete analysis leads to solid completions**

Combining all of these analyses with a perforation strategy helped the client avoid completion failures common in this reservoir, like fracture growth out of the zone, potentially into a water zone. The 3D anisotropic processing revealed that apparent fracture barriers in carbonate and high-clay intervals did not exist. Surface-passive microseismic monitoring of the hydraulic fracture treatment later confirmed this. The relevance of processing geomechanical data with an anisotropic stress model proved invaluable to the development of the reservoir.

Analysis of core data resulted in better placement for perforation clusters, optimized well trajectory for horizontal laterals, and enhanced production. This well, completed using TerraTek analysis, showed an average production increase of 500 Mcf/d.