Rock Fabric Awareness Can Make A Big Difference To Improve Completions

In July, the U.S. Energy Information Administration released a forecast for U.S. shale production that projected it would rise by almost 120,000 barrels a day. It also reported the ninth consecutive monthly rise. According to Reuters, this forecast includes the Anadarko region, where the rig count is second only to the Permian Basin.

Unconventionals, specifically shale oil, continue to pay a significant role in our industry as we move toward 2020 and beyond. One strategy EIA credits for these operations’ success, even during uncertain economic times, is the use of improved drilling and completion technologies that aim at optimization and efficiency.

In July, I attended the Unconventional Resources Technology Conference in Austin, Tx. This growing event is put on annually by a partnership among the Society of Petroleum Engineers, the American Association of Petroleum Geologists and the Society of Exploration Geophysicists. The event draws more than 2,500 individuals and is founded on the premise that shale plays continue to hold a significant place in the world’s energy future. Not surprisingly, between technical papers and the robust tradeshow, innovations in unconventional oil and gas exploration, drilling and production could be found everywhere.

One of the more interesting aspects of this event is how it successfully merges engineers, geologists and geophysicists into the same show. Getting these groups into the same room for three days helps to better link these disciplines that depend on each other in the industry. One URTeC paper in particular caught my attention and illustrated the link between geoscience and engineering. Titled, “Constructing High Resolution, Inch Scale Continuous Logs via Multi Domain Approach to Improve Hydraulic Fracturing by Capturing Thin Beds in the Bone Springs Formation, Delaware Basin, Reeves County, Tx. (URTeC: 2670758)” by Santhosh Narasimhan, Pukar Mainali, Harry Rowe, Austin Morrell, Wesley Ingram, Andy Benson, Nathan Ganser and Sean Arrington from Premier Oilfield Laboratories, this paper explores the importance of understanding rock fabric and its implications for hydraulic fracturing.

The authors review the importance of developing and creating cost-effective production in shale plays. This is not a new idea. For many years, technological innovations have been developed and employed to optimize completions. Typically, these innovations come in the form of equipment or operational improvements. However, these authors assert that fine-scale reservoir characterization derived from high-resolution core data can improve completions dramatically, although it is often underutilized.

To show how integrating these properties can improve a fracture propagation model, the authors created and analyzed high-resolution continuous logs from core analysis in the Bone Springs. They began with one-inch, high-resolution core measurements using X-ray fluorescence (XRF) and one-foot X-ray diffraction (XRD) scales.

XRF works simply by shooting an X-ray into a sample of core. This beam reacts with the core’s atoms, helping researchers identify chemical signatures within the sample that are analyzed to help determine core composition. This determination, in turn, can help evaluate the rock’s geomechanics.

Similarly, XRD analysis helps scientists identify core samples and cuttings based on the structure of crystals within the sample. During the process, each sample gives off a unique pattern of diffraction, allowing it to be compared with other well-known patterns and helping to identify the sample properly, again with the goal of using this data to evaluate the reservoir and design optimal frac models.

In this case, the authors suggest standard logs simply cannot achieve resolution sufficient to address thin bed layering effects adequately. The small, one-inch scale features can impact fracture and production modeling dramatically. In an effort to identify and evaluate the region’s thin beds, researchers developed a suite of tests to capture the small changes between the geochemistry of the cores, helping to profile each layer.

The paper’s authors concluded that the log-based models from standard sonic log resolution were inferior to those that were rationalized by integrating geochemistry to capture the thin bed effects. The authors found that a multi-domain integrated approach that included logs and high-resolution models illustrated the importance of multiple thin beds and the impact on the hydraulic fracturing workflow. For the Delaware Basin, it became clear that the high layering effects must be characterized to adequately optimize the frac geometry for proper reservoir engineering applications. Overall, the high-resolution chemostatigraphic core measurements in this region were essential to an optimized completion process.

As unconventional exploration and production continue to grow our industry, it is essential to evaluate every opportunity to find efficiencies and optimization workflows. As events such as URTeC continue to bring multiple disciplines together, these innovations will continue to occur as geology, engineering combine to develop innovation.

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