CSUR
Canadian Society for Unconventiona Resources

The power to Connect. The power to Convene. The power to Inform.

August 2021 – CSUR Technical Webinar

Duvernay a gift that keeps on giving: Leveraging geomechanics for hydraulic fracturing optimization in the Kaybob area

AUG 31 2021

CSUR Canadian Society for Unconventional Resources

TECHNICAL WEBINAR SERIES

DUVERNAY A GIFT THAT KEEPS ON GIVING: LEVERAGING GEOMECHANICS FOR HYDRAULIC FRACTURING OPTIMIZATION IN THE KAYBOB AREA

PRESENTED BY
ERFAN SARVAR AMINI, PH.D.. P.ENG. GLJ LTD.

When it comes to technical plays within the Western Canadian Sedimentary Basin, Central Alberta's Duvernay Formation is likely considered one of the more challenging with most operators that undertake operations in this unconventional play. Although there are distinct regions (Kaybob, Willesden Green & East Shale Basin) for the Duvernay, our guest speaker, Erfan Sarvar Amini, a Geomechanics Specialist with GLJ Ltd., elaborated on his work on Duvernay wells in the Kaybob area. The scope of Erfan's study was based on leveraging existing geomechanics data to potentially engineer better wells, including assessing for the ideal landing depth for the lateral within the preferred Upper Duvernay layer and defining an optimal completion design to maximize production rates & overall recovery.

In setting the stage for his talk, the speaker first provided a brief geological and stratigraphic overview of this organic rich, laminated mudstone. Generally for most operators, the significantly thicker Upper Duvernay is the primary target, with the thinner Lower Duvernay being the secondary target. Using available core, pressure, various logs, mechanical, and other standard & advanced datasets from an existing Kaybob Duvernay well drilled for data collection by Shell Canada Limited, the speaker described how he created a Mechanical Earth Model (MEM) and the accompanying "Failure or Competency Index" to determine optimal drilling and completion strategies.

The MEM was then used to conduct a sensitivity study on various parameters. For example, the study revealed that most operators in the Kaybob area landed their wells in the middle of the primary Upper Duvernay target. However, the results from the simulation study suggested that the "ideal" landing spot may be closer to the bottom of the zone. With the lower landing depth, the model suggested improved conformity, better frac containment (lower frac height), and

the creation of a new set of fracs (horizontal) that ran parallel to the bedding planes or laminations. Based on the model results, the speaker speculated that these newly created horizontal fracs could potentially enhance the production profile of the wells. Subsequent model sensitivity work using higher frac injection rates with the lower landing spot yielded complete conformity (better proppant transport & distribution, created even more horizontal fracs, and increased stimulated rock volume or SRV around each frac stage).

Finally, the speaker touched on the concept of the Extreme Limited Entry completion design to improve cluster efficiency, frac geometry and proppant distribution (SRV). This completion style is becoming more dominant in the US Lower 48 shale plays, but has also been utilized in select Montney wells in Canada now.

SUMMARY

The organic-rich Duvernay Formation located in central Alberta is one of the most prolific source rocks in Western Canadian Sedimentary Basin. Despite many extensive multi-stage HF treatments, the geomechanics and fracturing behavior in the Duvernay have not been fully understood.

The geomechanical behavior of the Duvernay source rock is interesting and unusual. It has significant hydrocarbon storage with nano-Darcy scale permeability and lacks any evidence of significant pore connectivity due to the absence of widely spread microfractures if the rock is not immediately close to a lineament or fault. The latter has led to a complex and unusually overpressured system in the rock.

Real hydraulic fracturing examples from Duvernay stimulation require large treatment pressures and injection volumes but lack clear indications of fracture breakdown/initiation. The ISIPs often exceed the overburden stress. These behaviors, combined with extremely slow pressure fall-off after shut-in, can be all interpreted as signs of creating an induced complex HF fracture network. This complexity is a necessary condition for economic hydrocarbon recovery in the nano-Darcy permeability Duvernay source rocks.

This talk will discuss the development of a new methodology to identify and characterize the geomechanical sweet spots in Duvernay source rock. Using this technique, it will be shown that the majority of the wells in the Kaybob Duvernay are not landed in the highest fracable intervals. Using a series of simulation, we will show case the benefits of targeting highest fracable intervals leading to a better frac containment, while maximizing the stimulated rock volume during multi-cluster plug and perf frac jobs.

PRESENTER: Erfan Sarvar Amini, Ph.D., P.Eng. GLJ Ltd.

Erfan Sarvar Amini is a geomechanics specialist with GLJ Ltd. Erfan holds a Ph.D. degree in Geomechanical Engineering with on a focus on the hydraulic fracturing (HF) modeling and characterization of tight hydrocarbon reservoirs in Western Canada. For the past 10 years, Erfan has been employed in the development of novel simulation technologies for characterizing geomechanical behavior of hydraulically stimulated reservoirs and deep underground waste disposals. Erfan has presented his contribution to the field of geomechanics and hydraulic fracturing at over hundred international conferences and has authored several articles in a number of internationally recognized journals.

Sponsored by

TECHNICAL WEBINAR

Duvernay a gift that keeps on giving: Leveraging geomechanics for hydraulic fracturing optimization in the Kaybob area

presented by Erfan Sarvar Amini, GLJ Ltd.

Tuesday, August 31th, 2021 | 10:00am MT
pre-registration is mandatory

Sign Up Now !!