ARMA Future Leader Webinar Series

Every Two Weeks on Fridays 9-10 am MT (11 am – 12 pm ET)

Wellbore Stability Analysis of Wells in Paradox Play in Southeastern Utah: Investigating the Impact of Salt Mobility

Pengju Xing

Energy & Geoscience Institute, the University of Utah

Friday, July 12, 2024, 9-10 am MT (11 am – 12 pm ET)

https://stonybrook.zoom.us/j/9539339965?omn=96069259795

Abstract

The Paradox Oil Play in southeastern Utah could be among the most significant unconventional plays in the western USA. However, due to the unique geomechanical setting of salt/clastic cycles, it has witnessed several drilling challenges that may impact its future development. These include pipe sticking and well control events due to the high formation pressure in the reservoir sections. We conducted a comprehensive investigation into certain pipe sticking incidents, such as two pipe stuck incidents in well State 36-2LNW-CC, using drilling data, wireline logs, and laboratory core test data. Several issues were identified as possible causes including wellbore stability associated with extensive salt interbedding between clastic layers. Multiple primary modes of salt mobility were identified, including creep, fault slippage in either the evaporites or the clastics, and more conventional wellbore instability, any or all of which could have contributed to pipe sticking.

The analysis of creep in halite at 9,000 ft TVD in well State 36-2LNW-CC – near the location of a pipe sticking incident - shows that associated wellbore closure due to creep could exceed 10%. This shrinkage was calculated by integrating salt creep parameters derived from laboratory core testing and drilling data. The significant wellbore shrinkage likely played a role in the stuck pipe incident, possibly exacerbated by changes in inclination and azimuth while drilling in the salt. Furthermore, assessment of the mud weight and caliper data from eight offset wells underscores a correlation between deeper well locations, smaller mud weights, and increased wellbore shrinkage possibly due to salt creep.

In addition to creep, fault slippage (or even simply near-wellbore failure) within various salt (or clastic) formations also emerges as a contributing factor to pipe sticking. There is compelling evidence that elevated pore pressure in regions where these “pipe sticking” incidents occurred heightens the likelihood of fault slip. Understanding these mechanisms, as presented in this study, is crucial in mitigating future drilling challenges and ensuring the efficiency of operations within the Paradox Oil Play.

Biography

Dr. Pengju Xing is a research associate at Energy & Geoscience Institute, the University of Utah. Dr. Xing has over 10 years' working experience on geomechanics, both in industry and academics, in numerical simulations and laboratory experiments. His expertise is on enhancing energy extraction from subsurface with engineering treatment, including geothermal, unconventional oil/gas resources, etc. He has experience in developing analytical solutions, numerical codes, laboratory experiments, and data-based methods related to various geomechanics applications.

Dr. Xing has worked on different projects including: numerical modeling of the stimulation for Enhanced Geothermal System (EGS), DOE's FORGE project; in-situ stresses measurements for geothermal and oil/gas reservoirs with newly proposed temperature signatures and flowback methods; machine learning models to predict formation properties using drilling data; simulation of the circulation in Raft River EGS project; numerical modeling and experimental investigation of hydraulic fracturing growth in layered reservoirs; thermal-hydrological-mechanical analysis in hydrate bearing sediments.