CONCLUSIVE PROOF OF WEAK BEDDING PLANES IN THE MARCELLUS SHALE AND PROPOSED MITIGATION STRATEGIES

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Abstract:

Wellbore instability has been experienced in areas of the Marcellus Shale and can become particularly troublesome in the superlaterals that are becoming more prevalent in that play. Often the instability while drilling these very long lateral wells is minimal; problems are more likely to occur while tripping out after reaching TD. The most common instability events when pulling out of the hole appear to be tight hole, pack-off and stuck pipe. These problems often worsen with time, indicating there is some time-dependence to the failure mechanism.

In order to develop effective mitigation strategies to combat the instability, it is imperative that the failure mechanism be correctly identified. Previous publications (Kowan and Ong, 2016; Addis et al. 2016; Riley et al. 2012) have suggested that bedding planes may play a role in some of the drilling problems experienced in the Marcellus Shale. In this paper, we will present a case study from the Marcellus that shows conclusive proof of weak bedding plane failure along a lateral well, where thousands of feet of anisotropic failure were captured with a LWD image log.

This image provided confirmation of the presence and failure of weak bedding planes in the Marcellus Shale. The image was also used to validate an existing geomechanical model for the area and gave the operator more confidence in the mitigation strategies developed from that geomechanical model, which had been based on the assumption that weak bedding was contributing to difficulty experienced on multiple lateral wells when tripping out of the hole.

This case study will begin with an overview of the geomechanical model, including the drilling history, stress/pore pressure model and rock properties. Next, some highlights from the image log, showing anisotropic bedding plane failure, will be featured as well as a comparison of the image to the geomechanical model. This case study will conclude with a review of proposed mitigation strategies that could be implemented by the operator to limit the risks posed by weak beds and minimize instability, when drilling laterals in this area, or similarly complex areas, of the Marcellus Shale.

Bio:

Julie Kowan has over 15 years' experience enabling operators to drill safer, more cost-effective wells and plan field development by reducing non-productive time (NPT) due to wellbore instability and improving production. She has expertise in unconventional reservoirs, pore pressure prediction, stress constraint, wellbore stability, fracture permeability and compaction. Ms. Kowan began her career as a Geomechanics Associate at GeoMechanics International (GMI) in 2005 before being promoted to Specialist and Advisor positions at GMI and Baker Hughes. From 2016 to 2018, she ran her own successful consulting company, J. Kowan Consulting, LLC, before re-joining Baker Hughes in 2018. Ms. Kowan earned a Master of Science in Geology from Brown University and a Bachelor of Science in Geology from Rutgers University. She served as Vice President of the Boston Chapter of the SPWLA from 2017-2019 and as Secretary from 2015-2017.