Wellbore Stability: Special Considerations for the Marcellus Shale

By Julie Kowan and See Hong Ong

Wellbore stability problems such as tight hole, pack-off, stuck pipe, inflow, and lost circulation are most commonly associated with conventional reservoirs but also occur in unconventional reservoirs. Prevention of wellbore instability saves time and money and can often be achieved by deriving a field-specific geomechanical model to inform the drilling recommendations. A basic geomechanical model consists of an understanding of the pore pressure, vertical stress, orientation, and magnitude of the horizontal stresses and the rock properties, though, of course, there are additional complexities that sometimes need to be considered.

We will use a generalized Marcellus Shale example to illustrate some special considerations regarding wellbore stability in unconventional reservoirs. First, as many areas of the Marcellus have fissile shale bedding, we investigate how much additional mud weight is required to prevent excessive wellbore collapse when weak bedding planes are present. We show that in some cases, the mud weight required to control shear failure is high enough to cause pre-existing fractures and faults to slip, which can cause additional mud to invade the formation. In such cases, if mud invasion cannot be prevented through the use of lost circulation materials, raising the mud weight can actually exacerbate the instability. We also examine the feasibility of underbalanced drilling and the effect of model uncertainties on our predictions.

Biographical Sketch

Julie Kowan is a Geomechanics Consultant with over 12 years experience helping operators drill safer, more cost-effective wells and plan field development by reducing non-productive time (NPT) due to wellbore instability and improving production. Julie has expertise in unconventional reservoirs, pore pressure prediction, stress constraint, wellbore stability, fracture permeability, and compaction. Prior to launching J. Kowan Consulting, LLC in June 2016, Julie was a Geomechanics Advisor at Baker Hughes from 2009 to 2016. Before being promoted to Advisor, Julie held several other technical geomechanics positions at Baker Hughes and GeoMechanics International from 2005 to 2009. Julie earned a Master of Science in Geology from Brown University and a Bachelor of Science in Geology from Rutgers University. She currently serves as the Vice President of the Boston Chapter of the SPWLA and was the Chapter Secretary from 2015 to 2017.

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