AAPG Datapages/Search and Discovery Article #90244 © 2016 AAPG-SPE Joint Forum Reality-Based Reservoir Development: New Teams, Techniques, Technologies, Oklahoma City, Oklahoma, September 23, 2015

Using Geomechanical Modeling to Quantify the Impact of Natural Fractures on Well Performance--Application to the Wolfcamp

Nicholas Umholtz

FracGeo

Abstract

This study describes workflows to quantify the impact of natural fractures on the performance of shale wells. First, a method described by White *et al.*, (2014) is reviewed to illustrate the regression analysis approach which may be used on a small area where many image logs and production are available. Then, a general workflow that combines Geophysics, Geology and Geomechanics (3G) is discussed and applied to a Wolfcamp well. The benefits of the 3G workflow are threefold. First, the quantitative impact of the natural fractures on the regional stress is provided through the differential horizontal stress variation which impacts frac complexity. Secondly, an effective modeling technique which accounts for the interaction between the hydraulic and natural fractures in creating the reservoir strain and drainage pathways is described and validated using microseismic data. Thirdly, the ability of this model to identify the poor hydraulic frac stages due to the excessive or low fracture density encountered along the wellbore is discussed.

The impact of natural fractures on the efficiency of a hydraulic fracture is quantified using geomechanical modeling that is able to identify poor hydraulic frac stages clustered where there are too many natural fractures near faults or around low fracture density zones. The best hydraulic fracture stages appear to cluster where there are sufficient natural fractures to create complexity, and are often proximal to large natural fracture trends associated with faults.

Building on the validated 3G workflow, a well placement workflow that takes into the account the quantitative impact of natural fractures on the well performance is demonstrated on the considered Wolfcamp B well. The workflow provides the optimal position of a well in the presence of natural fractures associated with a fault system that could produce undesirable water.