A Prediction Method of Fractures around the Wellbore Using Reservoir Geomechanical Properties Constrained by Sedimentary Microfacies - A Case Study of the Cretaceous Reservoir in Kuqa Depression

Haitao Sun[1], Hui Zhang[2], Dakang Zhong[1], Zhimin Wang[2]

[1]China University of Petroleum – Beijing
[2]Tarim Oil Field

Abstract

There were developed the ultra-deep and low porosity sandstone reservoir of Cretaceous, in the Kuqa Depression, Tarim Basin. This reservoir has experienced strong tectonic compression and developed a large number of natural fractures, which can be opened by hydraulic fracturing to increase natural gas production. How to selected sandstone beds with natural fractures to be reconstructed is important to increase the production of a single well. This paper studied the reservoir characteristics, geomechanical properties and hydraulic fracturing effect of Cretaceous sandstone in BZ gas field by using core, thin section, logging, geostress and production data.

According the results, the hydraulic fracturing effect is not always increasing with the development of natural fractures in the wellbore. We believe that the development of the natural fractures around the wellbore, which area the hydraulic fracturing influences, may be one of the key factors to increase the production. The change of reservoir sedimentary microfacies and rock fabric caused the difference of the rock mechanical properties. The difference of quartz content, clay matrix content, grain size and sorting of the sandstones in different sedimentary microfacies results in the difference of rock mechanical parameters such as Poisson's ratio and Young's modulus, and thus causes the difference of the natural fractures development between different wells, also between in the wellbore and around the wellbore. Based on the above understanding, we optimized the rock mechanics parameter models using the sedimentary microfacies model, then building the model of natural fractures around the wellbore. The prediction reliability of the new model has been increased greatly. The innovation of this study is to combine sedimentary petrology with reservoir geomechanics. Through analyzing the influence of rock fabric on rock mechanical properties and applying it to the modeling process of reservoir natural fractures for the first time in the study area. This method could solve the three-dimensional characterization of natural fractures around the wellbore, in case of intensely tectonic compression and no useful seismic data. We believe this study could present effective suggestions on reservoir hydraulic fracturing and increasing gas production.