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Research article

Assessing the challenges of production from unconventional gas reservoirs from a geomechanical point of view

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English Extended Abstract

Summary

The current research deals with the comprehensive and systematic investigation of the geomechanical aspects of unconventional reservoirs such as shale gas reservoirs, tight gas sandstone reservoirs, gas hydrate reservoirs and carbon dioxide injection reservoirs, and their drilling and hydraulic fracturing challenges, including the casing and liner collapse, have been discussed from the geomechanical point of view. In this article, case studies on the geomechanical investigation of the Marcellus, Long Maxi, Roseneath, Murteree and Montney gas fields in the countries of America, China, Australia, and Canada are also considered that which results are important in estimating static and dynamic parameters as well as designing the hydraulic fracturing in gas shale reservoirs.

Introduction

Considering the extent of unconventional gas reservoirs and the exigency of optimal production from these resources, the design of hydraulic fracturing operation according to the geomechanical aspects is the most important step in the exploitation of these resources. Oil and gas sources differ from each other in many aspects, such as the shape of source and reservoir rocks, mechanisms of formation, penetration, distribution and occurrence. Unconventional reservoirs are resources that cannot be exploited economically with conventional resource extraction methods.

Methodology and Approaches

Before drilling, the reservoir is in equilibrium, and no special stress causes the reservoir to collapse, but after the drilling operation, stresses are applied to the reservoir as induced stresses, which cause the loss of balance and instability in the wellbore. In this regard, the greater the distance from the center of the well, the stresses will decrease. Knowing the direction of minimum and maximum horizontal stresses helps engineers to predict the possibility of casing collapse.

Results and Conclusions

Due to the low permeability of the unconventional gas reservoirs to achieve optimal production from these sources, geomechanical parameters are of particular importance. To increase production from these sources, one of the most widely used operations worldwide is a hydraulic fracture. One of the important components in studying the propagation of hydraulic fissures is the difference in horizontal stresses. According to what has been obtained based on geomechanical studies in Roseneath and Murteree formations, for reservoir rocks with low horizontal stress such as sandstone reservoirs, the fracture pressure of the formation is much lower. However, the shale reservoir with more horizontal stress has more failure pressure and the fracture in these reservoirs has less expansion. On the other hand, studies in the Montney Formation indicate that Poisson's ratio and Young's modulus affect the characteristics of shales such as their fragility. In this regard, a formation with a lower Young's modulus is more difficult to fracture and is not considered a suitable option for hydraulic fracturing operations.

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