SPE 109565

A Case Study: Using Wireline Pressure Measurements to Improve Reservoir Characterization in Tight Formation Gas—Wamsutter Field, Wyoming

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This paper was prepared for presentation at the 2007 SPE Annual Technical Conference and Exhibition held in Anaheim, California, U.S.A., 11–14 November 2007.

Abstract

Improving recovery in tight gas reservoirs typically mandates infill drilling programs. Characterization of reservoir pressure depletion and sand body continuity are fundamental to determining the economic viability of these projects. An elusive challenge has been to gather fit for purpose pressure data in these tight formations due to the nature of the rock and the granularity of the data necessary. This case study summarizes results for a wireline pressure data collection campaign on twenty wells where more than 120 pressure measurements were taken in the Wamsutter Field, Wyoming.

The observations presented in this case study serve as a model for what can be achieved in similar fields using these techniques. The conditions and limits of pressure data applicability in this environment are set forth.

In tight gas reservoirs new generation wireline tools which employ extremely precise pretest mechanisms can achieve the required data acquisition objectives more efficiently than long-established methods. However, wellbore conditions and data acquisition procedures can greatly influence the quality and limits of data application. A field description, operational lessons learned, data quality observations and conclusions are presented.

This case study represents a statistically significant collection of detailed pressure data in a partially developed, complex, tight formation gas field collected with new generation wireline technology. Operational, interpretation and application recommendations for wireline pressure measurements in the tight gas environment are included.

Introduction

Wamsutter Field refers to a large, continuous tight formation gas (TFG) accumulation in the Washakie and Red Desert Basins of the Greater Green River Basin located in southwest Wyoming. Discovered in the 1950s, it encompasses 1,700 square miles and is one of the largest tight gas resources in North America. The field area has produced 2 TCF from over two thousand wells since discovery in the late 1950's. The primary productive interval is the Almond Formation of the Mesaverde Group, comprised of shallow marine sandstones deposited along the western margin of the Cretaceous Seaway. Changing sea-levels resulted in the deposition of a mixed suite of sand, silt, shale, and coals in a complex sequence of tidally-dominated deposition. This large stratigraphic trap is draped over the Wamsutter Arch, a structural up-lift dividing the Great Divide Basin to the north and the Washakie Basin to the south (Figure 1). The combination of deposition, structure, and diagenesis control reservoir presence and quality, and ultimately dictate well performance and optimal well density.

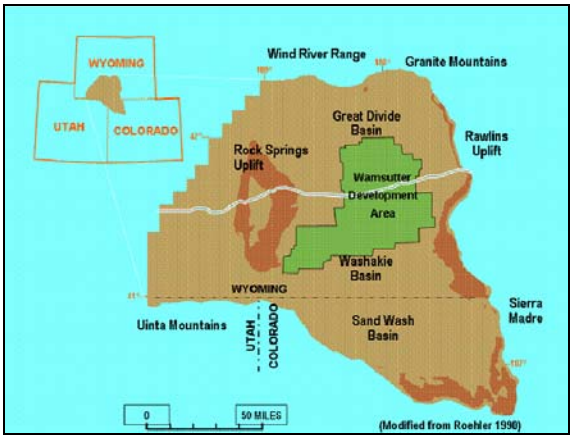

Figure 1: South Central Wyoming Regional Geologic Setting (Ryder, R.T. 1988)

Improving recovery in tight gas reservoirs mandates equally tight well spacing, driven by reservoir connectivity, permeability, well costs and gas prices. Tight gas fields typically go through multiple rounds of downspacing dependent upon development pace, well performance maturation, increased reservoir characterization information and technology advancements. This somewhat haphazard and quite often protracted end-state can lead to less than optimal surface kit