

Research Summary

Flow in Fractured Carbonates Associated with Source Rocks

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Layered Unconventional Reservoirs

Production from thin, fractured layers

Producing layers sandwiched between layers of very tight (source) rock

Horizontal wells Hydraulic fractures Multiple phases





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Support from the source rock layers

Source rock may feed into the producing layer if it has fractures (a transient dual-porosity model)

Productive layers are usually adjacent to thermally mature, kerogen-rich shales.

In these cases, both the source and producing rocks have a high fracture density along with a large residual oil content





High velocity contrast between fractures & matrix or shale & producing layers

Conventional Dual-Porosity Normal component of matrix velocity is high



Unconventional Dual-Porosity Normal component of matrix velocity is low



Boundary condition between the fracture and matrix: Beavers & Joseph Brinkman ???

Boundary layer thickness: ???



- Develop a model to understand the flow mechanisms in extremely tight fractured layer systems.
- Understand the interaction between the carbonate and source rock layers
- Develop a methodology to analyze and interpret production data

Phase 1 – Single-phase flow Phase 2 – Multiphase flow



- Describe the fluid flow taking place in layered unconventional reservoirs
- Investigate the possible flow mechanisms in the source rock layers i.e. fractures/diffusion/desorption due to the pressure depletion in the adjacent carbonate layers
- Model the support from the source rock layers to neighboring carbonate layers through the interface and cross-border fractures
- Develop pressure and rate-transient models for singlephase flow
- Extend the results to multi-phase and condensate flow



Current Status of the Research

- The research was initiated by an industry request to develop a production data analysis tool for multi-layer gas production
- The initial objective was to extend the single-layer gasproduction data analysis tools to multi-layer systems using the convolution-based approach of Spath et al. (1994)
- The model has been under construction and testing
- The initial premise was the existence of continuous production logging data
- Currently, we are trying to work with surface rates



Approach



Kick-Off Meeting, November 16, 2012, Golden, Colorado

Results/Status



