

Sensitivity Analysis of Oil and Gas Volumes in a Frontier Basin: What Matters Most? Source Rock Thickness, TOC, Temperature or Seal Capacity?

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Abstract

Preliminary basin modeling in a frontier basin showed a wide range of possible trapped volumes by varying the source rock TOC, source rock thickness, temperature gradient and trap seal capacity. To assess the impact of the four main unknowns, several models were run. Four scenarios were created for seal capacities increasing from 50 to 250 psi. Scenarios 1 and 2 used 100-foot source and 1 and 3% TOC and temperature gradients of 30°C/km and 40°C/km. Scenarios 3 and 4 used the same parameters and a 300-foot source rock. Thin source rocks with low TOC's in higher temperature gradients environments will improve substantially the generated oil volumes. Thick source rocks, even with low TOC's and low temperature gradient can generate substantial oil volumes. Thick source rocks with low and high TOC will generate equal amounts of oil for traps with low seal capacities. Traps with higher seal capacities will have the gas fraction displace oil and reduce the resulting oil volume. For thick high TOC source rocks, higher temperature only increases the gas generation. The tornado plot shows the maximum values for a combination of parameters and seal capacities. The largest amounts of trapped oil are from thin or thick, high TOC source rocks in a high temperature gradient and in traps with medium capacity seals that allow gas leakage.