

Complex Structural Geometry within a Single Thrust Sheet and its Effect on Well Deliverability

Normand Bégin* and Bob Quartero
Talisman Energy Inc., Calgary, Alberta
nbegin@talisman-energy.com

Over the last five years, extensive horizontal drilling for gas in Mississippian carbonate thrust sheets has taken place in the Central Alberta Foothills Belt. Such wells have mainly targeted the crestal position of hangingwall anticlines in sheets carried several hundreds of meters above the regional carbonate platform. In a single thrust sheet detached from a gliding horizon in the Shunda Formation, four horizontal wells (W1 to W4) were drilled in the Turner Valley Formation. The wells have been producing gas for about a year from a highly fractured and dolomitized reservoir. The sheet has dimensions of at least 10 km long by 1.5 km wide. Two of those wells, W2 (750 m-long horizontal) and W4 (2 legs of a combined 850 m-long), were drilled respectively along-strike of the sheet, towards its NW and SE lateral terminations against the Cretaceous siliciclastic rocks. Both wells encountered each at least five fault-bounded imbricates of the Upper Porous and Middle Dense members, intersecting little of the best portion of the Turner Valley reservoir in the Lower Porous member. FMI/Dipmeter data confirmed the structural complexity of the wells, with individual compartments of distinct strike and dip panel geometry. The imbricates are bounded by moderate angle reverse and normal faults, with an extremely high microfracture density over the majority of W2 and W4. Wells W2 and W4 tested at rates of 15-20 mmcf/d and 10-12 mmcf/d, respectively. Although less of the primary target (Lower Porous) was drilled than would have been preferred, the abundant faults and high fracture density allow for good communication throughout all apparent compartments of the reservoir. Well W3 was drilled for 875 m horizontally from a backlimb position (dips 15-25° SW) to a crestal position (dips 5-10° SW) of the thrust sheet, along the center portion of the thrust sheet. W3 intersected mostly the Lower Porous member, with no evidence of structural complication compared to W2 and W4. The well tested at 19 mmcf/d. Well W1 was drilled 900 m horizontally in the Turner Valley reservoir, mainly in a backlimb position after starting in the crestal portion of the thrust sheet. Well W1 did encounter only one fault repeat within the reservoir, in a backlimb setting. The well tested at a rate of about 10 mmcf/d.

Those results show that structural complexity is more likely to occur near the lateral termination of the thrust sheet, compared to the backlimb-to-crestal portion of the sheet. Compartmentalization of the reservoir is created by transverse features, such as lateral ramps mainly and normal faults. Although the best part of the reservoir was not always intersected in wells with complex fault imbricates, the well deliverability was not compromised, provided that distinct compartments are linked through several sub-vertical opened fractures. Pressure data and the relation to reservoir continuity will be discussed.