

Initiation of the Turtle Mountain Thrust as Demonstrated by Surface and Subsurface Data, Crowsnest Pass, Alberta, Canada

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The initiation of the Turtle Mountain Thrust is investigated. Surface mapping (Langenberg et al., 2007), information from nearby wells and a seismic line were used. Time processing helped to enhance signal in the data, establish reflectors and tie them to surface geology and synthetics of the wells. These reflectors were then recognized in a depth migrated section to establish a realistic geometry.

In the Foothills and Front Ranges of Alberta folding and thrusting appear to operate simultaneously. However, in the case of the Turtle Mountain Thrust it appears that folding predates thrusting during the initial shortening. The thrust-ramp in the competent carbonates is localized by a buckling instability in the layered succession in an early stage of shortening and buckle-folding. The thrust fault ramped through the fore-limbs of the Turtle Mountain Anticline (initially a detachment fold) and defines a fault-propagation fold in a later stage of the buckle-folding process. The Turtle Mountain Thrust has a prominent footwall syncline, which fits the fault-propagation model. Consequently, the prominent process in these layered strata is buckling, whereby thrust faults initiate at buckling instabilities. The Turtle Mountain example will be compared to structures in the Lewis, Rundle and Nikanassin thrusts.

Buckle folds can be modified by fault-bending at a later stage, after thrust faults formed. After the initiation of these types of thrusts, large displacements along these thrusts could be accommodated. The evidence of initial folding might have moved a long way from the location of the ramp, leaving only evidence of later fault-bend folding or showing no folding at all. The McConnell Thrust shows examples of this type of behavior.

References

Langenberg, C.W., Pană, D., Richards, B.C., Spratt, D.A. and Lamb, M.A. (2007): Structural Geology of Turtle Mountain area near Frank, Alberta; Alberta Energy and Utilities Board, EUB/AGS Earth Sciences Report 2007-01.