Seismic Imaging of the Overturned Limb of a Footwall Syncline in the Alberta Foothills of the Canadian Rocky Mountains and Its Impact on Exploration

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ABSTRACT

The deformation model for the Alberta fold and thrust belt has frequently been interpreted as being a fault bend fold model. Based on an interpretation of a modern seismic line we would suggest that some parts of this structural domain deviate from this interpretation. We will show an interpretation that has an early detachment fold that has been later modified by a major thrust fault. In an effort to better understand the Alberta Foothills a seismic line was acquired in 2005. It is 52km long and runs SW to NE across the structural strike of the surface geology. A regional section from the Alberta Geological Survey runs parallel with the seismic line 3km to the NW. On this section a major thrust, the Brazeau Thrust is interpreted with approximately 25km of dip slip movement on it. This thrust carries Paleozoic Carbonates in the hangingwall which outcrop at the surface. The footwall cutoff is interpreted to be at 5km depth in the regional Paleozoic. The deformation model for this interpretation can best be described as following a fault bend fold style of deformation. An interpretation of the seismic line has provided a substantially different model for the Brazeau Thrust. In this interpretation we show a sub thrust overturned fold limb of Paleozoic Carbonates imaged in the seismic section. This new interpretation would radically revise the deformation model for this part of the Brazeau Thrust. The new model would have a detachment fold with amplitude of 2km occurring early on in the evolution of the structure. Subsequent to the folding a thrust initiated and carried the back limb of the fold to the NE by 10km. The Brazeau Thrust is 120km long and is well explored. Many of the interpretations to date have invoked fault bend folding as a deformation model. The early detachment fold modified by a late stage thrust model is based on the interpretation of the new seismic and well data. The modified detachment fold appears to have developed along strike from Limestone Mountain, a major gas field formed in a duplex of Paleozoic Carbonates in the footwall of the Brazeau Thrust. As such it represents a rapid lateral change in the deformation model of this particular domain. This information will increase the risk of drilling a successful commercial gas well on the NW extension to the Limestone Mountain Field.