

The Turner Valley structure – 100 years of lessons

An old field teaching new tricks

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Abstract

The Turner Valley Structure was first described by R.G. McConnell in the 1880's as part of the Dawson Expedition whose mandate was to physically describe the western portion of the new Dominion of Canada. McConnell was part of the heroic days of exploration in western Canada where the young country was learning about its geography and geology simultaneously. During this effort McConnell noted a shift in the dip of strata along the Sheep River. By the early stages of the 20th century a ranch hand and amateur geologist, William Herron, had convinced A.W. Dingman to drill a well at Turner Valley, where he had sampled a gas seep that had been analyzed to contain heavy hydrocarbons and was "likely not swamp gas". That well, drilled in 1914, became the discovery well of the Turner Valley Field. Dingman #1 encountered a flow of gas and naphtha from a series of Jura-Cretaceous sandstones.

The discovery was quickly followed up with minor drilling as many of the oilfield workers were lost to the war effort in Europe and it was not until after the war that substantial drilling activity commenced. The Dominion government was aware that several financial scams were occurring as unscrupulous promoters were stealing the public's money under the guise of establishing drilling funds. To help stem this dishonest behavior, the Dominion government sent out geologists to map the structure and publish the results. D.K. Dowling published his map in 1914 and a subsequent map was made by Stanley Slipper in 1921. These maps showed a N-S trending anticline running through Turner Valley.

In 1924, Royalite #4 drilled deeper than previous wells and intersected the underlying fractured Mississippian carbonate section. This new discovery intensified the effort to develop the field. Through the late 1920's and early 1930's G.S. Hume mapped the Turner Valley Structure and showed a large anticline that extended from the small village of Longview in the south to the village of Millarville in the north. The structural style of the anticline went through several different interpretations by numerous authors including Ted Link, Bill Gallup and F.G. Fox. By the 1950's, the structural interpretation had evolved to be a large hanging wall anticline carried on a foreland verging thrust fault.

During the depression there was work in the oil field resulting in a massive influx of workers from across North America. Numerous worker towns developed with names like Little New York, Little Chicago, Royalties, and Naphtha to designate these pseudo-temporary work camps where the oil field hands lived. During the Second World War the oil field was viewed as a strategic resource and the oil workers were considered to be working in the nation's interest.

In the early 1960's seismic data had been shot across the field and the structure was interpreted as a wedge of deformed strata that was propagating into the foreland and delaminating the undeformed strata within the Plains. This type of structure was parochially described as the 'Triangle Zone' and competing mechanical models were developed by Peter Jones and Henry Charlesworth. Wedge tectonics became recognized as a regular style of contractional thrust systems in the Canadian Rockies and around the world in other thrust systems. Through the late 1980's and early 1990's wedge tectonics were described in detail with much of the interpretation based on lessons learned at Turner Valley. The Turner Valley Structure was re-interpreted as an antiformal stack at the leading edge of the

thrust belt and the role of fluid pressure became significant to the understanding in the development of the structure.

The Turner Valley Structure has gone through numerous interpretations by generations of geologists. Each interpretation pushed the envelope of structural understanding in its time. Generally the drilling of the field has been ahead of the structural interpretation such that the latest geologic analysis is designed to explain drilling or seismic results rather than as a predictor. The development of the structural interpretation of Turner Valley is a fascinating study in the development of a science and how theory and results must integrate and constantly evolve. Drilling in the Turner Valley Structure continues. It will teach the geologic community new aspects of the science and will continue to humble the geologist for at least another hundred years.