True StratigraphicThickness (TST); An Important Element in the Exploration for Foothills Oil and Gas Reserves

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One of the great unknowns for the Foothills Explorationist is the true stratigraphic thickness of a bed. Finding a formation that is unaffected by faults, steep dips or deviated bore holes is difficult.

This thickness has an impact on many aspects of the exploration and development of hydrocarbons in the Foothills:

- Velocity models for seismic depth conversion
- Wells prognosis
- Measurement while drilling (MWD) well monitoring
- Structural interpretation of objective horizons
- True thickness for sequence stratigraphic interpretation
- Balanced cross section construction
- Reserve calculations

The true stratigraphic thickness (TST) of a bed is calculated using:

$$TST = MT \cdot \left(\cos\psi - \sin\psi \cdot \cos\alpha \cdot \tan\phi\right) \cdot \cos\phi$$

(Tearpock and Bischke, 1991)

where MT = measured thickness, TST = true stratigraphic thickness, ϕ = dip, α = the dip azimuth minus the borehole azimuth, and ψ = borehole inclination from vertical (Figure 1).

In the talk we will look at how a program uses three dimensional trigonometry and interactive windows to correct a suite of logs. The programmer has used the proper technique to interpolate between dip points. This is done, in essence, by rotating the poles to the dips along the great circle containing the adjacent poles to dip. By using eigenvector analysis, vector mean, or vector median to average (smooth) the data, an accurate TST calculation can be then be made in zones of highly variable dip density and direction.

To illustrate the functionality of this technique, we will look at two examples from Foothills. The first one from the BC Foothills will illustrate this technique by converting a log suite from measured depth (MD) to TST in a Triassic fold. The second example from Alberta will use these calculations to correct the MWD gamma to TST. This allowed the operator to GeoSteer a horizontal well so that it stayed in a thin undulating reservoir horizon. At the same time the prognosis tool enabled the geologist and drilling engineer to predict intra-formation tops given a variety of drilling scenarios, there by reduce the engineering risk and contributing to a successful gas well.

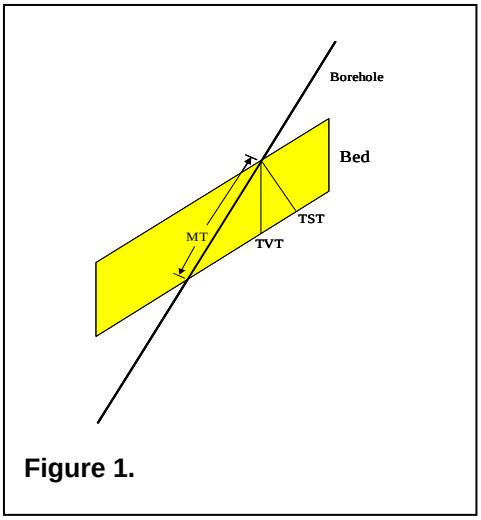

Figure 1.

References

Tearpock, D.J., and R.E. Bischke, 1991, Applied Subsurface Geological Mapping, Prentice-Hall, Inc. Englwood Cliffs, New Jersey.