Geosteering Horizontal Wells into the "Sweet Spot" of Thin Non-Conventional Reservoirs, Examples from the Cardium Sand of the Alberta Deep Basin

Andrew Newson
Moose Oils Ltd, Calgary, AB, Canada.

As we explore for and develop non conventional reservoirs, the impact of borehole position in the stratigraphic sequence and in the structural domain becomes critical. Very direct intervention is needed to geosteer the well into the correct stratigraphic and structural sweet spot. To do this we will use RDA* an interactive geosteering software to calculate the stratigraphic position of the borehole during drilling and relate it to the locally developed structure and fracture pattern.

Using a close offset gamma as a template correlation log, the software allows the user to calculate the bed orientation in 3D with fold axis and fault positions. In addition it can accurately calculate the sub seismic resolution fault throws. This is carried out in real time on the screen in a series of interactive steps while the well is being drilled. The key to this operation is the calculation of the True Stratigraphic Thickness (TST) of the reservoir horizon and the adjacent formations in each of the structural domains.

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

$TST=MT.(\cos\psi-\sin\psi.\cos\alpha.\tan\Phi).\cos\Phi$
TST = true stratigraphic thickness, MT = measured thickness, ψ = borehole inclination from vertical, α = the dip azimuth minus the borehole azimuth and Φ = dip. (Tearpock and Bischke, 1991)

In this talk we will show how RDA uses three dimensional trigonometry and interactive windows to correct a single log or a suite of logs from measured depth to TST. The software achieves this by rotating the poles to the dips along the great circle containing the adjacent poles. By using eigenvector analysis, vector mean, or vector median to average (smooth) the data, an accurate TST calculation can then be made in zones of highly variable dip density and direction. This can then be displayed real time as a Vector Section.

As an operational tool, RDA allows the operator to GeoSteer a horizontal well so that it stays in a thin undulating reservoir horizon. In addition, the prognosis tool enables the geologist and drilling engineer to predict intra-formation tops given a variety of drilling scenarios, thereby reducing the engineering risk and contributing to a successful well.

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

* RDA Dip Interpretation Suite is produced by Resdip Systems, Houston, Texas.