geoconvention
Calgary • Canada • June 20-22 2022

Exploiting of software application to overcome complex geological conditions while geosteering in Mungi Gas Field, Eastern Australia

Simon Cooper [a], Vinicius Beal [b], Denis Gavrilov [b]
[a] Cyberloop Australia Ltd., [b] ADAGA Solutions Ltd.

Summary

A long and complex geological generating history of Mungi Gas Field in the petroliferous Bowen Basin, located in Eastern Australia, has led to the intricate sediment variability and seam settings. The stratigraphical cross-section of Mungi field is constructed by multiply horizons of different rocks and extensive coal deposits interbedded with the siltstone zones bearing hydrocarbons (Towler et al., 2016). Such geological circumstances impose the technical challenges to petroleum recovery, resulting in drilling wide range of well types: from vertical to horizontal multi-lateral (fishbones) with associated entanglements while placing a borehole trajectory. In order to achieve a geosteering efficiency under described conditions, the innovative software applications which have the capability to simultaneously handle different geosteering scenarios with greater degree of certainty even with single GR measurements while remaining robust and easy to handle must be exploited by operational geologist.

Workflow

Three wells were drilled in the part of the Mungi Block, located within a thrust zone. It was prognoses at the beginning that the lateral sections of each well will intersect several low angles thrust faults at certain depths, based on 2D seismic data. Once the drilling commenced, each well however intersected the reverse faults and due to faults orientation, their actual depth became

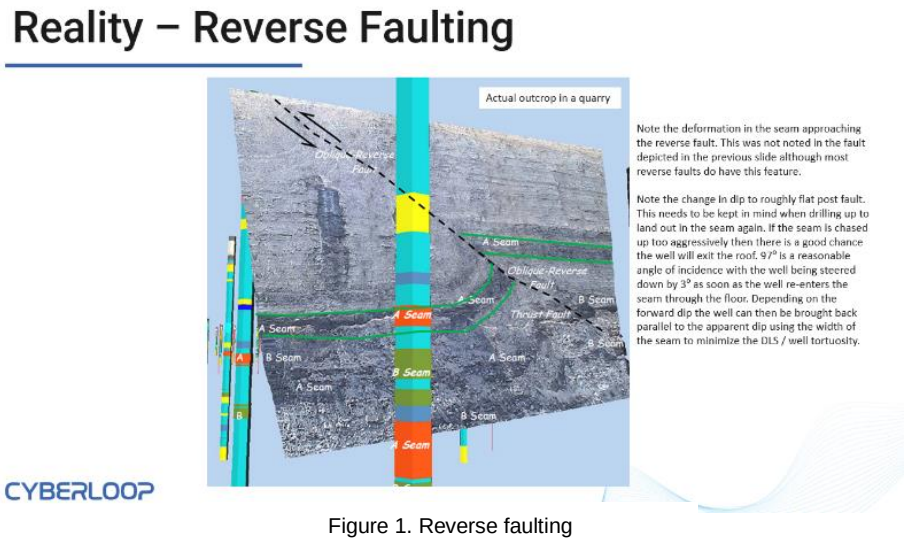

Figure 1. Reverse faulting
Source: Cyberloop Australia Ltd.

shallower that predicted. This made challenging to place the wells in the seam (with its thickness averaged at 2.7m TVT) once pass the fault, especially when the initial fault's throw was unknown. The shallow angle of the reverse faults created difficulties in differentiating between a normal stratigraphic exit to the seam top and an exit into the seam bottom at the reverse fault. It can be distinguished by considering where the well was initially modelled in seam versus the point of exit, at other reverse faults there is often a characteristic deformation of the seam in the footwall in the last few meters preceding the fault as shown on Figure 1.

This picture demonstrates a simple reverse fault. In the reality while drilling the wells in Mungi Block, the faults deformation was by far more severe with the hanging wall overthrust by 10s of the meters in some instances. This can be seen in one of the three laterals where the seam was intersected about 4m TVD above the seam in the footwall block. An additional problem was that the seam itself became the detachment plane as it was the weakest layer. Under such circumstances, the exact location of each fault could only be estimated (pre-well prognosis). A standard operating procedure dictates that the existing seam is geosteered up until the fault is intersected and only then is the well steered up to intersect the seam again. This is because it is not known how far the hanging wall has been overthrust laterally.

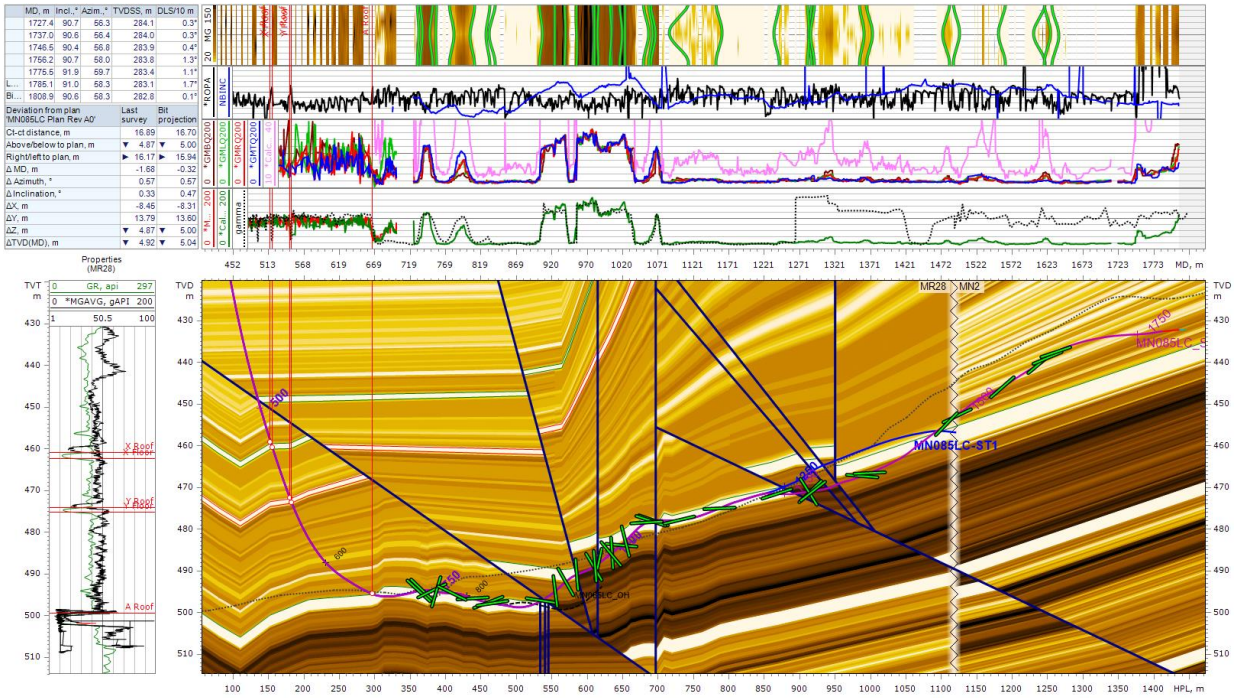

Figure 2. Geosteering scenario in geosteering software
Source: Cyberloop Australia Ltd.

Results

Innovative geosteering software can enable well placement engineers to accurately portray the reverse faults. This was imperative in the given example as the parent well intersected a section of seam that was about 4m TVD above the seam in the footwall block. The ability to model reverse

faults (as shown on Figure 2) allowed to drill two sidetracks off the parent well from the footwall block to the hanging wall block without exiting the gas bearing formation. These application's properties under described conditions are vital, so with the software that can only model up to vertical wouldn't help to achieve successful well placement results. The ease of creating and running simultaneously a number of geosteering scenarios greatly assisted to the well placement engineers in keeping an open mind as to what the formation structure is. Thus, it made possible to geosteer effectively under such challenging geological conditions in Mungi Gas Field.

Acknowledgements

We thank WestSide Corporation for making this challenging case to be presented and shared among professional community.

References

Towler, B. et al. (2016). 'An overview of the coal seam gas developments in Queenslan', *Journal of Natural Gas Science and Engineering*, 31, pp.249-271. doi: https://doi.org/10.1016/j.jngse.2016.02.040