

Structural Methods Used to Unravel Tectonic Shortening and Explore for New Plays in the Romanian East Carpathians

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The Moinesti Production Block is situated in the Romanian East Carpathians - part of Cenozoic Himalayan-Alpine orogen. The hydrocarbon province is mature, oil was first discovered in Moinesti in 1886 and the block has since produced 2.5 BBOE from 41 fields. E&P has focused on Miocene plays in the foreland basin and shallow Palaeogene thrust anticlines in the fold belt. Little potential remains in the upper fold belt; the majority of more than 5,000 wells exploit shallow targets. The challenge to identify new plays is problematic since the area is covered only by sparse seismic data where the harsh terrain and complex geology conspire to reduce the quality of what little reflection data is available.

In 2010 Petrom drilled a 3,700m well to test a deep play concept. The pre-drill model was generated from quantitative structural interpretations of depth-converted seismic lines conditioned by wells from nearby fields. These wells reportedly intersected Miocene and Oligocene sediments at 3,800m TVDSS. Interpretations were balanced and restored in concert with basin modelling analysis. The model invoked as much as 50km tectonic shortening and indicated scope for new plays at depth. The pre-drill interpretation was largely sustained, however drilling showed deeper Oligocene sediments were absent and the well entered Cretaceous units at 2,800m TVDSS. Penetration of the Cretaceous reduced the probability of deeper detachments and decreased the calculated tectonic shortening to 21km.

OBMI data indicated bedding dipped up to 72° to the southwest, SCAT analysis revealed the presence of sub-seismic thrust imbricates. This 'seismically cryptic' thrust-folding accounts for significant shortening not observed in reflection data increasing the revised shortening of 21km obtained by classic section balancing alone. Initial calculations of 50km tectonic shortening were over-stated, conversely the post-drill scenario under-estimates contraction since sub-seismic folding and thrust imbrication are not included into the calculations.