

MIANO FIELD, PAKISTAN, A CASE HISTORY OF MODEL DRIVEN EXPLORATION

Peter Krois, Tariq Mahmood, and Gerhard Milan

OMV (Pakistan) Exploration GmbH

The Miano gas discovery in Block 20 located in Sindh province is something of a geological puzzle. Its appraisal is also a case history of model driven exploration. The discovery well Miano-1 was drilled on what was originally mapped as a structural/ stratigraphic combination trap within the Lower Goru. Gas shows were encountered over the gross interval 3160.0-3900.0m, but most sands proved tight or produced water with some gas. Only one interval, the "B" sand, produced gas at high rates.

The productive reservoirs in the upper part of the "B" interval occur at different stratigraphic levels in the Kadanwari field some 15 km to the south as compared to those of the Miano field. The Miano "B" sand is interpreted to represent an incised valley complex comprising at least two members. Extension of these deposits to the west is predicted, associated with an increase in accommodation space basinwards; provided that sufficient sand supply was available. The incised valley complex is overlain by transgressive shoreface bar sands representing deposits of a transgressive systems tract. They comprise a gross back-stepping parasequence set, passing up from transgressively ravined shoreface deposits, through chamositic ironstones developed as nearshore condensed section during clastic shut down, into glauconitic mudstones, forming a deep marine condensed section and a regional seal.

At the level of the productive sand we do not recognize any structural closure although the relevant level can be mapped with reasonable confidence using seismic data. Subsequent appraisal drilling confirmed that we are dealing with a stratigraphic trapping configuration of a nature that has not been explored for in Pakistan up to now. A number of additional high-risk wells had to be drilled to develop an understanding of the geological trapping configuration and to derive plausible depositional models. NNW-SSE and NW-SE trending strike slip faults in an en-echelon pattern dissect the field. Reservoir quality ranges from negligible to excellent, varying significantly between lithofacies, facies and reservoir units. Variations in reservoir quality principally reflect differences in the development of early diagenetic grain coating chlorite and subsequent levels of quartz cementation. Mineralogy is also important especially the presence of even small amounts of the "hot" heavy mineral monazite, commonly mistaken for zircon, which can lead to high GR signatures in sandstones and potentially be the cause of overlooking sand-prone reservoir horizons.

The order of magnitude difference in vertical resolution between well and seismic data means that the application of seismic to reduce the risk in selecting drilling locations is rather limited. More wells using advanced logging techniques will have to be drilled to develop a better understanding of the Lower Goru reservoir system.