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Revisiting Field Structural Setup – A Case Study From A Producing Asset In Barmer Basin

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ABSTRACT

3D seismic, being the only laterally and vertically continuous dataset is heavily used to define the subsurface geology and thus form the basis for major strategic decisions towards appraisal planning and field development. However, limited availability of geological data coupled with poor seismic resolution generates a wide range of uncertainty. Structural interpretation using such dataset relies upon regional understanding of basin evolution and modeled tectonic style, further enhancing the uncertainty. The current study highlights, through a case study of a producing field in Barmer Basin, about such interpretational uncertainty that arise during early interpretation on limited dataset and shows that integrated interpretation synchronized with regional pattern results in completely different outcomes and has a significant impact on resource assessment and development planning.

Barmer Basin, located in the NW part of India is a NNW-SSE trending long, narrow and deep rift basin within the West Indian Rift System, north of matured hydrocarbon prolific Cambay Basin. The present day structural configuration of the basin is a result of multiple extensional episodes followed by a late stage strike-slip compressional episode. Three major fault trends are observed in the Barmer basin i.e. older NE-SW & ENE-WSW direction, which are affected and offset by younger NW-SE trending faults that define the Tertiary structural configuration of the Barmer Basin. The presence of reverse faults in the area near the youngest up-lifted structure named as the Airfield High is due to the late stage strike-slip compression related to the hard collision of the Indian plate with the Asian plate and uplift of the Himalayas. This compression has resulted in basin inversion and subsequent erosion of shallower stratigraphic units in the northern part of the basin.

This paper focuses on the ‘NE’ producing field in the Northern Province of Barmer Basin. NE field is situated on the western side of the basin and is located SW of the giant Mangala field and NW of the Airfield high. The available dataset comprises of 3 wells and a moderate quality 3D seismic volume that has undergone multiple vintages of reprocessing for image improvement. The initial structural interpretation work for NE field was carried out on a moderate quality post-stack time migrated processed volume by incorporating the structural knowledge generated from analogous discoveries in the basin. The initial interpreation assumed NE field to be a horst block with a typical NNW-SSE striking extensional fault to the west of structure and a normal fault on the eastern flank parallel to the western fault. However, this model failed to justify the bulge in shallower stratigraphy units related to later stage compression. Static Geo-cellular model was constructed using the same structural interpretation and used for resource estimation and exploitation strategy. The field was put on production and performance exceeded expectations.

New reprocessed PSTM seismic data, however, suggest evidence of reverse faulting in the eastern flank instead of normal. The new approach based on the seismic profiles, recently acquired well logs and age data, suggests that the Airfield high is a positive flower structure that has

been generated due to strike-slip compressional movements and reactivation of older generation faults during Miocene regional compression. The NE field having a similar structural strike as the Airfield high, has also undergone strike-slip compression and hence is surrounded by reverse faults. The compressinonal bulge in the shallower stratigraphic units is also justified with this theory of inversion. The field static model has been re-built, which has significant impact on field STOIIP, EUR, aquifer size and has also affected the injector well locations. This paper stresses upon regular up-gradation of structural framework and reservoir properties with new data and concepts for effective planning and reservoir management