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Near- Field Exploration In Mature Fields: Value Of Synergy In Adding New Reserves

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ABSTRACT

Exploration for new oil or more oil from matured fields in India continues to be beset with challenges. If low natural endowment is reason for reduced success in wildcat exploration in matured fields, the better proposition will be to focus on the concept that new oil is found near where it has already been found and produced. Exploration and production of hydrocarbons is a high-risk venture most often due to uncertainty in geological concepts with respect to structure, reservoir seal, and hydrocarbon charge. A definite tradeoff/advanatage of reward for risk is secured to a great extent on the basis of what we know and where we know it in matured fields. A lookback assessment on how a major oil-producing field in a matured basin was explored using this simplistic approach is presented here.

The field discovered in 1967 in a hitherto well-explored rift basin produces from high permeability sandstone reservoir of Eocene age operative under active aquifer support. This field with about 80 m maximum gross hydrocarbon column is a prolific producer challenged by preferential movement of water along certain trends, early water cut and sand incursion. At the time of exploring through an integrated, synergistic approach in the near-field area adjunct to the heartland, the field had produced about one-fifth of the oil originally in place. Recognition of exceptional production performance from a few flank wells of the field located close to the interpreted oil-water interface warranted a re-examination of the available geoscientific data for potential near-field exploration. Analysis of water encroachment trends in the heartland pay sands coupled with production performance behaviour of flank wells, when integrated with detailed structural mapping based on well data and sparse seismic data available indicated the possibility of an additional culmination adjunct to the heartland. This geological perspective is a credible interpretation of the data.

Implications of a key geological principle, Walther's law (facies which exist next to each other vertically must do so laterally, except at unconformities) when applied here to the riverine depositional system invoked the likelihood of the areal play to extend further spatially and revealed the possibility of adequate additional storage capacity. The field heartland had so far been depicted as a large anticlinal structure of simple type. However, in-depth mapping and analysis of all pervading data indicated the presence of multiple small amplitude culminations and troughs. The production performance of certain flank wells and water encroachment trends was indicative of more drainage area available than envisaged originally. The overall pattern was suggestive of new unidentified culminations closer to the synclinal axes which are beyond seismic resolution, making conventional mapping difficult. New satellite culminations were identified by integrating these observations. One such culmination was drilled and proved to be oil bearing beyond the flank of the heartland structure after nearly three decades of production history. The well yielded early production and reserves growth with success leading to new drilling targets. Further, after a time lapse of another decade, the geological concept remains tested and the culmination seems laterally extensive as the geometry of the culmination in cross-section is asymmetric with gentler limb on one side. The occurrence of additional older, deeper plays that are absent in the heartland

rejuvenated exploration. Confirmation of new areas by drilling would further enhance existing original oil in place of the field. Value addition by integrating geological concepts alongside sparse seismic data with production performance did prove here to be a significant tool for unravelling new oil in a matured heartland reinforcing the adage that the best place to find new oil is where there is old oil.