

Leveraging Technologies for Exploration in the Mature Barmer Basin, NW India

Shubhodip Konar¹, Kaushal Pander¹, Premanand Mishra¹, Vachaspati Kothari¹, V.R. Sunder¹, Stephen Goodlad¹, Pinakdhar Mahapatra¹

¹RJ Exploration, Cairn India Limited, Gurgaon, INDIA

ABSTRACT

The first exploration campaign in the Barmer Basin (1999-2008) led to the discovery of 25 oil and gas fields. Subsequently, during 2009-2012, Cairn India undertook extensive studies to exploit the remaining hydrocarbon potential in the basin. The studies led to a better understanding of the basin and its unique petroleum system. The improved understanding led to the generation of a diverse exploration portfolio with new prospects consisting of multiple play types and also resulted in de-risking existing leads and prospects. Missed opportunities from the first campaign were also incorporated in the exploration portfolio. The ongoing drilling campaign that commenced in 2013 has been very successful.

Regional studies based on both outcrop and subsurface samples have produced basin-wide structural and depositional environment maps. Ages are constrained with biostratigraphy and chemostratigraphy, as well as radiometric dating and Zircon Fission Track Analysis. These studies have provided an improved understanding of the stratigraphy and reservoir fairways in the basin. The stratigraphy underwent a significant revision suggesting the presence of a Mesozoic Play, beneath the Lower Tertiary discoveries. A well drilled in the current campaign established both source and reservoir facies, and a working Mesozoic petroleum system. Also, a number of stratigraphic plays were identified with additional seismic studies. Most of these stratigraphic traps have been drilled in the current campaign with commercial success.

Calibrated Basin Model incorporating geochemical analyses of source rocks, oils and, headspace gas, Fluid Inclusion Stratigraphy, uplift and thermal history reconstruction suggested significant “yet to find potential” in the basin. The maturity and transformation ratio maps helped in derisking prospects for charge availability using varying seal capacities.

Leveraging appropriate technologies in the Barmer Basin has helped overcome the mature basin’s challenges and resulted in a paradigm shift in the geological understanding leading to 12 new hydrocarbon discoveries in the last 2 years. In the 16years exploration history, 37 hydrocarbon discoveries were made through systematic understanding of the basin and its play types, source rock characterisation, charge modelling and judicious usage of state of art technologies. Current paper deals with the studies and technologies used throughout the exploration cycle to overcome the challenges and resultant success.