

'Evaluating Hydrocarbon Potential of Deccan Trap (Basaltic Reservoirs) in Padra Field of Cambay Basin for Its Effective Development Through Logging, Geological and Geophysical Techniques'

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Abstract: The exploration activities in Deccan Trap (Basaltic reservoirs) in Padra field of Cambay Basin though started in 1960's, yet, the development stage could not be reached due to uncertainties involved in discriminating reservoir facies and its hydrocarbon potential, which required to be addressed. Present attempt was to eliminate/ minimize such uncertainties by having a relook on related aspects like; Development of Porosity by Weathering / Leaching / Alteration by Hydrothermal Waters, Log data of drilled wells (48 nos.) drilled prior to the study in the light of Core data / Cutting data / Testing details / Production history, Relevant Seismic Data interpretation, Fault Pattern and Migration Pathways in different Lava flows.

Deccan Trap consists of a number of basaltic lava flows. The duration of each flow ranges from 0.5 Ma to 1.5 Ma. The time duration of successive flows have a bearing on generation of porosity in the upper part of exposed layer of each flow. Schrock (1948) compiled the number of flows and surface exposures. West (1999) has identified about 48 flows based on petrographic studies of continuous cores taken in eastern Saurashtra and Ahmedabad. When the duration between the two lava flows is more, the top of the flow has undergone weathering, till covered by the next flow. It is observed that the upper layers of the lava flows in the drilled section holds porous horizons, which are developed due to sustained weathering effects.

Well logs have played a key role in identifying the porous pods, the likely hydrocarbon seat, with neutron log leading the way. Utility of neutron log in identifying porous pods as compared to other logs has played a defining role in the present work. Interestingly, the neutron porosity reading ranging between 18-22% and resistivity values between 10-30 ohm-m indicate presence of oil in these weathered trap locales in each lava flow. Development of porous and permeable zones is also indicated by the SP deflection at places against the same zones validated by production logging results in five wells and build up study during conventional barefoot testing.

Integration of log data with seismic mapping and interpretation as well as drawing the fault pattern in the whole area could very well explain the depositional pattern, porosity development and migration model. Migration of hydrocarbons from Broach depression to the margins in the Padra field, has been facilitated by long distance (100-125 kms) migration by the combination of E-W transfer faults and their juxtaposition with Cambay Shale in the western side of the area.

Based on this study, the development, of the area in the middle host block as per our map at the Trap Top in closed grid, have given the best lead and all development wells are producing oil in large quantity more than the expected.

As per our map, other horst blocks are also required to be delineated. Moreover, three exploratory wells, which were kept on back burner due to lack of confidence, and one more exploratory well P-ww based on the study were drilled and all the four produced oil and gas from these reservoirs. The testing of wells in basalt reservoirs need to be done by lowering casing replacing the existing practice of testing barefoot, as a aftermath of this study, which has spurred up confidence to that level. This is also in line with the practice, followed by Russians in developing such basement rocks across the globe. This study is also useful for exploration and exploitation in Karzen field, south of Padra field up to which juxtaposition of Cambay Shale exists. .

Keywords : *Padra field, Deccan trap, Lava flows, Juxtaposition, Neutron log, Source rock, Migration*

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Introduction : Padra field located on the eastern raising flank of Cambay basin within Broach-Jambusar Block is surrounded by Dabka field in the west, Akholjuni and Cambay fields in the north, Karjan fields in the south. The Gravity- Magnetic survey was carried out in 1957- 58 to understand the broad structural configuration of trap/basement. The area is covered by seismic campaigns SIG -351, 330, 294 and 320. The exploratory work in this field was started in 1960 with hydrocarbon indications in the well Padra-a. The known reservoirs are Trap and Olpad Formations however, the hydrocarbons are also reported from Ankleshwar Formation in a few wells. The thickness of drilled section of Trap varies from 476m+ (Padra-d) in Padra

field to more than 3200m+ Ankleshwar Superdeep (ADP-a) in deeper part of the basin. Barefoot testing of Trap section was started from the well Padra-n onwards, Trap was drilled 40-200 mts, the well was cased and cemented with shoe within the Trap top).

If the well, produced oil/ gas, it was completed in the Trap. If the Trap section produced oil and water, then, the bottom 50m was sealed with sand/ cement plug and again trap section was tested barefoot before completion of the well as a producer. To confirm the hydrocarbon contributing zones, production logging was carried out in Padra-q, which indicated the contribution of oil from a 5m layer, 90mts below

