

REFOUND EXPLORATION OPPORTUNITIES IN INFRACAMBRIAN AND CAMBRIAN SEDIMENTS OF PUNJAB PLATFORM, PAKISTAN

Syed Tariq Hasany, Muhammad Aftab, and Raza A. Siddiqui

Pakistan Patroleum Limited, Karachi

E-mail: s_hasany@ppl.com.pk, m_aftab@ppl.com.pk, a_raza@ppl.com.pk

Punjab Platform represents the eastern segment of the tectonically stable Middle Indus Basin covering an area of more than 100,000 sq km and located roughly between 27.50N - 32 ON latitude and 70.30E -74.00OE longitude. Hydrocarbon search started in mid 1950's when Shell drilled first exploratory well, Karampur-1 in 1958, which provided an evidence for occurrence of heavy oil in Infracambrian; Infracambrian play is thought to be analogous to Oman. Out of a total of 23 wells in Punjab Platform, only 12 were drilled for Infracambrian and Paleozoic targets and rest of the wells for Mesozoic Play in a vast sedimentary basin. So far three gas discoveries have been made in Cretaceous aged Lumshiwai Formation and Jurassic aged Samansuk Formation, demonstrating to an extent, optimistic hydrocarbon prospects.

Thermal maturity data for Mesozoic indicated lack of mature source, and that the petroleum charge is from the long distance migration to the west. However, nonbiodegraded- sulfur rich heavy oil (API 17.6) data supported with age diagnostic biomarker from Baghewala-1 in adjoining Bikaner-Nagaur basin (India) highlights the occurrence of Infracambrian source which falls in early oil window. Karampur-1, heavy oil from Salt Range Formation interpreted to be geochemically similar to Baghewala oil. Maturity tends to increase with depth and deeper source rocks expected to be present in Punjab Platform. However, wells failure analysis suggests that lack of favorable mature source rocks are the major reason of failures.

This paper highlights the selected areas of better defined hydrocarbon prospectivity zones and will attempt to prove the significance of localized smaller scale subbasins. These sub-basins are expected to be present on basement. These grabens are identified on the seismic data and interpreted to be formed due to sculpting of the basement during Early Cambrian unconformity. Subsequent faulting and tilting may have reshaped the grabens. The source and reservoir rocks deposition and geometries therefore have largely been affected by the grabens geometries.

Source rock analysis of cores and cutting samples from wells that were drilled in the horst portray a negative picture regarding source maturity in the areas as the repeated subaerial exposures or non-conducive depositional environment may have severely affected the potential in the horsts areas. The grabens areas however, are expected to have better source quality and favorable maturation due to deeper burial and within the improved thermal regime than its chronostratigraphically equivalent sediments on structural highs.

Similarly, better reservoir intervals may also be preserved. Suitable structural, stratigraphic and combination traps formed as a result of tilting and uplifting of the basin through Phanerozoic are expected to be found. We also envisage that the role of the Infracambrian evaporites and carbonate/clastics sequences halite (salt), evaporites in the formation of a plausible complete petroleum system (source-reservoir seal and trap) in the basin is of critical importance.

Our interpretation is based on analysis of more than 2500 line kilometers 2D seismic data and time structure maps on Basement and Infracambrian and Paleo depth structure maps on Basement, present day Time structure map on Infracambrian, Isochron map on top Basement to top Infracambrian, interpreted restored seismic lines from Infracambrian, early Permian, Jurassic, Eocene, and present day seismic data and evaluation of exploratory well logs and other data.