

Fine Tuning the Petroleum Systems in Western Onshore Basin through Re-evaluation of Source Organics, Depositional Environments and Thermal Maturities of the Oils and Source Rocks

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The Western Onshore Basin is located on the western margin of the Indian craton and covers an area of approximately 56000 sq. km. From north to south, the basin is divided into five blocks, Sanchor-Patan, Mehsana-Ahmedabad, Tarapur-Cambay, Broach-Jambusar and Narmada-Tapti blocks. Western Onshore Basin has been divided in two sub-basins, namely, North Cambay and South Cambay. The salient aspects of the geology of Western Onshore has been discussed by Pandey et al., (1993) and Kundu and Wani (1992). The basin came into existence during Late Mesozoic era with the development of major tensional faults along pre-existing basement trends following widespread extrusion of Deccan trap basalt. This basaltic floor formed the basement for the deposition of a huge thickness of Tertiary-Quaternary sediments in the basin. The non-marine to marginal marine Olpad Formation was deposited over basement which is several hundred meters thick and has been observed to possess fair to good hydrocarbon potential in certain areas. The Cambay Shale Formation unconformably overlies the Olpad Formation and it represents the first major transgressive episode in the basin. The shale is grey to dark, fissile, often carbonaceous and rich in disseminated organic matter. Geochemical studies have established the Eocene Cambay Shale as the regional major source rock. The Cambay Shale is conformably overlain by the Kalol Formation in the North and its equivalent Hazad Formation in the South. Kalol and Hazad are the major reservoirs in the Cambay Basin and are inferred to pinching out towards the basin margin areas. The Kalol Formation is mainly sandstone/siltstone with alternations of shale and coal while Hazad Formation is mainly sandstone. Both these time equivalents were deposited in a prograding deltaic facies. Kalol and Hazad reservoirs are effectively capped by the marine transgressive Tarapur Shale of Late Eocene- Early Oligocene age. The Early Oligocene is followed by a hiatus due to complete withdrawal of the sea from the basin. The Neogene section is represented by marine to fluviodeltaic interbedded shale and sandstone and it includes the Miocene Tarkeshwar, Babaguru, Khand and Jhagadia formations. Pliocene-Pleistocene sedimentary rocks are represented by Broach and Jambusar formations consisting of claystone and sandstone. Recent alluvium covers the entire basinal area except the outcrops along the eastern margin. The entire Neogene section is immature for hydrocarbon generation but is a part of overburden rocks necessary to create thermal maturity in the Cambay Shale and Olpad formations.