Petroleum System in Indian Collision Zone: Perspective from Structural Geology – Dilip K. Mukhopadhyay, Department of Earth Sciences, IIT Roorkee, Roorkee - 247667. (E: <dilipfes@gmail.com)

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Petroleum systems have four essential elements that include source rock, reservoir rock, seal rock and overburden rock, and two processes, i.e., trap formation and maturation-migration-accumulation of hydrocarbons. The essential elements and processes must have appropriate temporal and spatial relation such that organic matter included in source rock is converted into petroleum accumulation of possible commercial interest. A basin is considered to be petroleiferous basin where all these essential elements and processes are known to occur or have a reasonable probability to occur.

For a petroleum system to exist, the most important element that must be present is a rich source rock, i.e., marine black shale. However, appropriate source rocks are not uniformly distributed through geologic time. The most important source rocks are found in Upper Jurassic/Cretaceous/Oligocene-Miocene successions. Other important but lesser source rocks are found in Palaeozoic successions of Silurian, Upper Devonian and Lower Permian times. In recent years, Neo-Proterozoic rocks deposited following probable “snow-ball earth” event have also been considered possible source rocks.

Cenozoic tectonic of India is dominated by still active two collision zones: collision between Indian and Tibetan plates in the north leading to the rise of mighty Himalayan mountain chain, and between Indian and Burmese plates in the NE resulting in Assam-Arakan fold and fold-thrust belt. Both these collisions occurred during early Cenozoic and have produced large swath of foreland sedimentary basins, which

produced fold-thrust belts (FTB) during Neogene due to continued convergence, deformation and shortening. In addition, shelf sediments (so-called Tethyan Sedimentary Zone, TSZ) deposited at the leading edge of the greater India during its northward journey has also been deformed during Neogene convergence and collision. Beyond western syntaxis, the northern collision extends into Pakistan, which straddles both Indian and Eurasian plates.

Proven petroleum system exist in Assam-Arakan belt to the east and in Pakistan in the west with several producing oil/gas fields. However, no oil/gas fields have been discovered within the Himalaya from Kashmir to Arunachal Pradesh. There are two sedimentary belts in the Himalaya, viz., the Tertiary sedimentary belt in the frontal part and Proterozoic to Cretaceous TSZ to the north. These two sedimentary belts are separated by the high-grade metamorphic zone of the Greater Himalaya. Structural considerations suggest that Petroleum systems may be present in the FTB in western part in Himachal Pradesh and Kashmir Himalaya with possible source rocks occurring in the Subathu Group. Petroleum system may also occur in the Tethys Sedimentary Zone with possible Palaeozoic source rocks. The Tertiary sequence west of Himachal along with Indo-Gangetic plain do not appear to have good Hydrocarbon prospect. The NE India remains only hope for Petroleum system to occur in the Indian collision zone, requiring that petroleum exploration should be intensified in Arunachal Pradesh, through Nagaland, Manipur to Mizoram.

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