

New Paradigm In Himalayan Foreland Exploration: Challenges And Opportunities

Vikas K Singh¹, Manish Shukla¹, Yadunath Jha¹, Ashish C Shukla¹, Neha Rawat¹, B.K. Mangaraj¹, and Hari Lal¹

¹Oil and Natural Gas Corporation Ltd., India

ABSTRACT

Indo-Eurasian plate collision initiated during Lower Eocene and its continued convergence along northern margin of Indian plate have initiated development of peripheral foredeep/ Himalayan Foreland on leading underthrust Indian plate. Tertiary sedimentation started in foredeep in front of the rising mountain province of the Himalaya over peneplained Proterozoic sedimentary base. Himalayan Foreland is exposed in fold thrust belt between Main Boundary Thrust (MBT) and Himalayan Frontal Thrust (HFT); and in subsurface extend below the Ganga valley alluvium. 1st exploratory well in Himalayan Foreland was drilled in 1954 to chase the surface gas seep from Neogene sediments in Jwalamukhi area. Subsequently extensive surface and subsurface data was acquired in Himalayan Foothills (HF) and Ganga Valley (GV) to establish the Tertiary/Neo-Proterozoic petroleum system elements. In spite of number of thermogenic gas seeps and oil shows in HF and GV, drilling couldn't established the viable petroleum system. In spite of scanty and fragmented data, available source rock, gas and oil seeps data were relooked and exploration model is envisaged.

In HF and GV based on surface and drilling, two lithology accredited to pre-collisional and post-collisional Himalayan orogeny have been dominantly established. Pre-collisional Neo-Proterozoic platformal limestone/ dolomite of Shali/Shimla/Krol and Bilaspur formations along with metasediments and Post collisional Tertiary continental/marine clastic sediments of Siwaliks/ Dharmshala/ Subathu formations.

Tertiary sequences at surface and sub-surface all along the Himalayan Foreland found to be immature to expel the thermogenic hydrocarbon. The geochemical signatures of surface oil seeps recorded near MBT indicates presence of anoxic mature marine petroleum system that is related to Proterozoic carbonates. These signatures have been compared with Proterozoic Vindhyan oil seep and Neo-Proterozoic Baghewala heavy oil and found to be genetically comparable. Stable Carbon Isotopic values of $\delta^{13}C_1$ of the gas samples from Tertiary sequences of HF and Neo-Proterozoic sequences of GV shows similar maturity. Maturity indication point toward the mature petroleum system which is rather unlikely for the Tertiaries but likely for the Neo-Proterozoic.

Considering the geochemical signatures, the authors opine that the Neo-Proterozoic platformal carbonates may have generated hydrocarbon which remained pooled in deeper complex strati-structural Proterozoic as well as Tertiary traps. Thus necessitating a shift in focus from Tertiary exploration model to Neo-Proterozoic exploration model in Himalayan Foothills.