

Geochemistry of Petroleum Potential Source Rocks in Barracuda Well of Mannar Basin, Sri Lanka

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Four exploration wells (Dorado North, Dorado, Barracuda, and Wallago) were drilled in the deep-water Mannar Basin during the second phase of hydrocarbon exploration. The Barracuda well was confirmed as gas potential due to presence of 85 wt% methane in the Upper Cretaceous sediments. Therefore, the current study focused to evaluate geochemistry of core sediments (depth from 2139–4741 m) in Barracuda well using X-Ray Diffraction (XRD) and stable isotopes analyses. The upstream petroleum industry prefers such supportive geochemical data at the development stage. Stable carbon ($\delta^{13}\text{C}$) isotopic values (-33.86‰ to -24.88‰) and C/N ratios (17.3–158.8) suggest a considerable supply of terrestrial plants organic matter (gas prone Type III kerogen) to sediment. XRD results identified several paleoclimatic chronozones based on dominant clay mineral assemblages. The Early Campanian age consists of montmorillonite dominant sediments suggesting that arid climate. Kaolinite dominant Late Campanian to Late Maastrichtian sediments indicates the warmer/wetter paleoclimatic condition. However, montmorillonite dominant sediments in the Late Maastrichtian can be controlled by short-term global cooling events and/or volcanogenic sediments followed by Deccan-Reunion basalt volcanism. The Early-Late Paleocene sediments in the Barracuda well suggest arid (mock aridity) climate in the Indian Ocean. The Late Paleocene to Middle-Late Eocene age is composed of kaolinite dominant sediments that correlate warmer and wetter greenhouse paleoclimate in the Indian Ocean. The Early-Middle Oligocene to Miocene sedimentary succession of the Barracuda well also contains kaolinite dominant clay mineral assemblage. This wet climate characteristic is linked to the sharp decline of atmospheric CO_2 concentration followed by the growth of Antarctica ice sheets after the Eocene-Oligocene climate transition (ca. 34 Ma) and development of present-day South Asian monsoon system.

Keywords: Paleoclimate, Sediments, Clay mineralogy