

Organic Geochemistry and Oil-Source Correlation of Cretaceous Sediments in the Kohat Basin, Pakistan

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Abstract : The Cretaceous Chichali Formation in the Chanda-01, Chanda-02, Chanda-03 and Mela-05 wells and the oil samples from Chanda-01 and Chanda-01 wells located in the Kohat Basin, Pakistan, were analyzed with the objectives of evaluating the hydrocarbon generation potential, source, thermal maturity and depositional of organic matter, and oil-source correlation by employing geochemical screening techniques and biomarker studies. The total organic carbon (TOC) values in Chanda-02, Chanda-03 and Mela-05 indicate, in general, poor to fair, fair and fair to good source rock potential with low genetic potential, respectively. The nature of organic matter has been determined by standard cross plots of Rock Eval pyrolysis parameters, indicating that studied cuttings from the Chichali Formation dominantly contain type III kerogen at present and show maturity for oil generation in the studied wells. The organic petrographic study also confirmed the vitrinite (type III) as a major maceral in the investigated Chichali Shales and its reflectance values show maturity for oil. The different ratios of non-biomarkers and biomarkers i.e., steranes, terpenes and aromatics parameters, indicate the marine source of organic matter deposited in the anoxic environment for the Chichali Formation in Chanda-01 and Chanda-02 wells and mixed source input of organic matter deposited in suboxic conditions for oil in the same wells. The CPI, and different biomarkers parameters such as C₂₉ S/S+R, $\beta\beta/\alpha\alpha+\beta\beta$, M₂₉/H₃₀, Ts/Ts+Tm, H₃₁ (S/S+R) and aromatic compounds methyl phenanthrene index (MPI) and organic petrographic analysis (vitrinite reflectance) suggest mature stage of oil generation for Chichali Shales and oil samples in the study area with little high thermal maturity in case of oils. Based on source and thermal maturity biomarkers and non-biomarkers parameters, the produced oils have no correlation with the Cretaceous Chichali Formation in the studied Chanda-01 and Chanda-02 wells in Kohat Basin, Pakistan, but it has been suggested that these oils have been generated by the strata containing high terrestrial organic input compare to Chichali Shales.

Keywords : Organic geochemistry, Chichali Shales and crude oils, Kohat Basin, Pakistan

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