

INTERPRETATION OF PALEODEPOSITIONAL ENVIRONMENT USING BIOMARKERS AND CARBON ISOTOPE ($\delta^{13}\text{C}$); A CASE STUDY FROM TALANG AKAR FORMATION, SOUTH SUMATRA BASIN, INDONESIA

Jamaluddin¹; Cheng Fuqi¹; and Kamran Shehzad^{1,2}

¹*School of Geosciences, China University of Petroleum (East China), Qingdao, China,*

²*Departement of Geology, Khushal Khan Khattak University, Karak, KP, Pakistan*
kamrangeoscientist@gmail.com

Abstract

Understanding depositional environment of a source rock is critical to source rock characterization. Upper Oligocene, Talang Akar Formation is a proven hydrocarbon source rock in South Sumatra basin, Indonesia. The formation contains dominant shale at the top, with some sandstone interbeds. Whereas it contains coarse to very coarse sandstone beds at the bottom. The lower sandstone unit also contains carbonaceous shale and some coal seams. This study uses 3 crude oil sample and 10 well-cutting obtained from two well (SMT-1 & SMT-2) in Prabumulih oil fields, South Sumatra Basin. Biomarkers and carbon isotopes ($\delta^{13}\text{C}$) data used to determine the paleodepositional environment of Talang Akar Formation. The biomarkers data were obtained from gas chromatography (GC) and gas chromatography-mass spectrometry (GC-MS) analysis of normal alkanes, isoprenoids, triterpene, and steranes. Carbon isotopes ($\delta^{13}\text{C}$) include saturated and aromatic fractions. The pristine (Pr) to phytane (Ph) ratio is a good indicator of the depositional environment. Higher values of Pr/Ph ratio i.e. ≥ 3.0 indicate oxidizing conditions i.e. terrestrial while lower values in the range of 1.0-3.0 suggests siliciclastic-dominated marine conditions. However, very low values i.e. ≤ 1.0 indicate reducing conditions or fresh and brackish water conditions. The results in this research show that Pr/Ph ratios range from 7.90-16.66, characteristic of high wax crude oils, primarily originated in fluvial and deltaic environment containing a significant amount of terrestrial organic matter. Similarly, the resultant ratios of Pr/n-C₁₇ and Ph/n-C₁₈ in SMT-1 and SMT-2 wells range from 0.91-10.72 and 0.11-1.29 respectively, which reflect that most of kerogen was derived from humic source and tend towards an oxidative environment of deposition. Cross-plot of carbon-13 isotopes ($\delta^{13}\text{C}$) shows saturated versus aromatic fraction. The resultant plot indicate a deltaic to marginal marine environment for SMT-2 well and a more marine environment for SMT-1 well. The oil/source rock correlation analysis using biomarker data shows that the oils in Prabumulih field is correlated with the oils in source rock of Talang Akar Formation. This study concludes that the source rock contains abundant humic organic matter that was deposited in a transitional (Fluvio-deltaic) to marginal marine environment under oxic conditions