

Identification of Potential Hydrocarbon Source Rocks Using Biological Markers in the Kohat-Potwar Plateaus, North Pakistan

MR. ASIM SHAHZAD, MPHIL, PHD¹, PROF. JINGQIANG TAN, PHD¹, SYED ASIF AHSAN², IFTIKHAR AHMED ABBASI³ AND DR. SYED MUZYAN SHAHZAD, PHD⁴

¹Central South University

²ADNOC Onshore

³Sultan Qaboos University. Sultan Qaboos University

⁴Geosciences and Info Physics Geosciences Building Central South University No.932 South Lushan Road

Presenting Author: asimshahz@csu.edu.cn

The Kohat and Potwar Plateaus in north Pakistan are important oil and gas producing areas. For decades, exploration activities in these areas, of lower Himalayan region, have continued. Recent discoveries in MOL's (Hungarian Oil & Gas E&P Company) Tal and OGDCL's (Pakistan state-owned oil and gas E&P Company) Nashpa blocks, however, have aroused interest in this region.

18 outcrop samples were collected from various locations inside the Surghar Range and the Salt Range to better understand the variance in quality and maturity of different probable source rocks in the Kohat-Potwar areas. The age of these materials ranges from Triassic to Eocene. To understand the source rock quality and its fluctuation both stratigraphically and regionally, bulk characteristics determined by pyrolysis were used. To examine the maturity variance of samples, vitrinite reflectance values were determined on a few selected samples. Furthermore, well cuttings from Chanda 1 and Chanda Deep-1 (Datta Formation) wells, as well as two crude oil samples (also from the Datta) from each of these wells, were used to compare the biomarker distribution in the cuttings, oil samples, and the potential source rock samples analysed in this study. This has aided our comprehension of the oil-oil and source-oil relationships. To better understand the source rock-oil and oil-oil correlation, multivariate statistical studies were performed on the depositional environment and maturity parameters of source rock and oil. Based on source parameter data, oil samples CH1 and CHD1 plot closely together on a Dendrogram, indicating genetic correlation. These samples are presumably from sub-oxic to anoxic marine shale deposited in an estuarine or open sea environment. Based on PN3 and DN1, the Patala and Datta formations in Nammal Gorge may be the probable source rocks for these oils. Many biomarker source criteria connect the oil seeps CS1 and PS1. The likely source of the seeps is carbonate or evaporite, according to the biomarker source criteria. Based on the C₂₇-C₂₈-C₂₉ regular steranes ratio, oil seeps may have originated in open sea environments where algae or phytoplankton predominate. By comparing dendrograms based on thermal maturity, we can deduce that two crude oil samples' source rock was comparable.