
PHYSICO-CHEMICAL CONTROLS ON SOURCE ROCK IN OFFSHORE INDUS COMPARATIVE STUDY OF SOME MAJOR TERTIARY DELTA OF THE WORLD

Syed Asif Ahsan, Rizwan Khan, Yasir Naveed, Mudasar M. Saqab

Pakistan Petroleum Limited, Karachi

ABSTRACT

Offshore Indus (Pakistan) contains one of the major Tertiary deltas of the world and is considered an attractive exploration frontier. The Indus Fan, the second largest submarine fan in the world after the Bengal Fan, started to develop since Late Oligocene and contains more than 10 km of Tertiary sediments over Deccan Volcanics. Exploration activities in Offshore Indus were initiated in 1961-62. A fair coverage of seismic data exists and 13 exploratory wells have been drilled with no commercial success. Only 1 well, PakCan-01, encountered non-commercial gas, with flow rate of 3.7 MMscfd composed of 97% CH₄ and 2.7% CO₂, from Middle Miocene sandstone.

Predominant lithologies of the drilled section indicate both lateral and vertical variations depending on depositional processes and position in the basin. Consequently, parts of the basin with low energy conditions, i.e., lagoons, outer shelf and the inter-volcanic seamounts depressions, received fine and shaly sediments in anoxic environment. Over-pressures have been encountered in the Miocene section in different wells drilled in Offshore Indus (e.g., Indus Marine A-1, B-1 and C-1). These over-pressured intervals, having huge thickness, might have retained the hydrocarbons beneath them or in potential stratigraphic traps in the area.

An integrated approach using basin modeling and seismic data is essentially required to minimize risks associated with: a) source presence/maturity; b) migration/HC charge; and c) reservoir-seal pair, before selecting a suitable candidate for drilling. A comparative study of some of the major Tertiary basins, including Offshore Indus, related to deltas has been carried out to understand similarities and differences in physico-chemical controls on source rock deposition, maturation, hydrocarbon generation and expulsion in Offshore Indus. 1D basin modeling was applied to three Offshore Indus wells to understand timing of maturation and expulsion of hydrocarbons. The results of the study will potentially reveal the characteristics, presence and effectiveness of a Tertiary Petroleum System in Offshore Indus Basin.