Integrated Approach for Facies Identification and Saturation Height Modelling; (Case Study from a Middle Indus Stratigraphic Field)

Azaz Hassan[1], Faizan Ahmed[1], Mustafa Atiq[1], Fahad Arif[1], Attique-Ur-Rehman[1], Iftikhar Abbasi[1], and Udo Bregar[1]

[1]OMV, Pakistan

Abstract

Most studies on reservoir characterization and evaluation have concentrated on identification of depositional facies based on the assumption that depositional characteristics and diagenetic features control the petrophysical properties. In sandstone reservoirs, this assumption is usually valid but may be applicable only locally. In this case study, there were discrepancies in the depositional facies at various well locations with their porosity and permeability ranges overlapping each other and therefore hydraulic rock typing approach was adopted in the area of interest.

Facies identification plays a key role in permeability and saturation height modelling, and therefore has the basis in the physics of flow at the pore network scale. This basis is best achieved by seeking functional relationships between core derived pore throat parameters and macroscopic petrophysical attributes such as porosity and permeability when rocks of similar fluid conductivity are identified and grouped together. Each such grouping is referred to as a Hydraulic Flow Unit (HFU).

HFU methodologies were used on the data set such as Winland R35 and Pittman (1992), and discovered that the effective pore system that dominates flow through the pore system of interest corresponds to a pore throat size at which the mercury saturation is 45%. Using Pittman R45 equation, 4 sets of facies were identified on the poro-perm plot. The klinkenberg and net over burden corrections were applied on porosities and permeabilities before performing the analysis.

The appropriateness of facies classification was determined with comparison of permeability and saturation prediction with core permeabilities and log saturations respectively. Saturation height methods such as Leverett J Function, Brooks Corey, Thomeer and Lamda were investigated for the gas wells under study, which had complete data sets including conventional core, SCAL and a comprehensive suite of electric logs.

This paper demonstrates the effectiveness of HFU methodology for the field case under study. It also highlights the aptness of facies identification for the subject field using different saturation height methods, discussing their pros/cons in course.