

## PETROGRAPHICAL AND PETROPHYSICAL ASSESSMENT TO EVALUATE THE RESERVOIR POTENTIAL OF THE UPPER PERMIAN ZALUCH GROUP, UPPER INDUS BASIN, PAKISTAN

Mukhtiar Ghani<sup>1,2</sup> Irfan U. Jan<sup>1</sup>, and Hafiz Shahid Hussain<sup>1,3</sup>

<sup>1</sup>National Center of Excellence in Geology, University of Peshawar

<sup>2</sup>Geological Survey of Pakistan, Saria road Quetta.

<sup>3</sup>Pakistan Museum of Natural History, Islamabad.

### Abstract

The Late Permian Zaluch Group is researched and modelled for their reservoir properties using petrographic and petrophysical analyses in the Upper Indus Basin. Three outcrops sections, i.e. Zaluch, Nammal, and Gulakhel gorges and ditch cuttings from Bahu-01 Well were used for petrographic studies. Petrophysical data was used from Isakhel-01, Dhermund-01, Khaur Oxy-01 and Bahu-01 wells located in the Potwar sub-basin.

The petrographic studies showed, that only one facies, i.e. the siliciclastic wackstone of the Amb Formation represented good porosity values which is uniformly distributed in the basin. The quartz wackstone and dolomite facies of the overlying Wargal Formation indicated good porosity value, however the distribution of quartz wackstone is restricted to western corner of Upper Indus basin, while dolomite facies is uniformly distributed within it. In Chhidru Formation, only sandstone facies can be treated as prospective facies in terms of porosity which showed great thickness in southern part of the basin. Based on petrophysical analysis, Average porosity ( $\Phi_A$ ) and Effective porosity for the Amb Formation ( $\Phi_E$ ) increased towards northeast and decreased towards southwest. Permeability increased in the Trans-Indus Basin, while Cis-Indus Basin showed fair permeability ( $k$ ) values. The Volume of shale ( $V_{sh}$ ) is higher in Potwar Basin as compared with the Punjab plain. For Wargal Formation, Average porosity ( $\Phi_A$ ) and Effective porosity ( $\Phi_E$ ) increased towards south and decreased towards north. The Permeability increased in the Trans-Indus Basin, while Potwar Basin, Punjab plain and Central Indus Basin showed fair to poor permeability ( $k$ ) values. The volume of shale ( $V_{sh}$ ) is low in the Potwar Basin and high in the Punjab plain. For Chhidru Formation, Average porosity ( $\Phi_A$ ) and Effective porosity ( $\Phi_E$ ) increased towards south and decreased towards north. Permeability increased in the Cis- and Trans-Indus basins, while Punjab plain and Central Indus Basin showed fair to poor permeability ( $k$ ) values. The volume of shale ( $V_{sh}$ ) is lower in the Potwar Basin and higher in the Punjab plain. The primary porosity is severely destroyed by diagenetic events, hence producing secondary porosity, making them good reservoirs across Potwar sub-basin.