

## **Fractures Analysis of Sakessar Limestone Exposed along the Surghar Anticline: Implications for Assessing Secondary Porosity and Permeability for its Potential as Hydrocarbon Reservoir**

**M. Irfan Faiz<sup>1</sup>, Sajjad Ahmad<sup>2</sup>, Abdul Jabbar Malik<sup>1</sup>, Fayaz Ali<sup>2</sup>, and M. Irfan Khan<sup>3</sup>**

<sup>1</sup>*Baker Hughes Inteq, Qatar*

<sup>2</sup>*Department of Geology, University of Peshawar, KPK*

<sup>3</sup>*MOL Oil & Gas Co., B.V. Islamabad-Pakistan*

The Surghar Anticline is a well-exposed east west trending surface anticline located in the Surghar Range, which forms the southeastern frontal range of Kohat Foreland Basin. The anticlinal core provides an excellent exposure of platform sediments ranging in age from Jurassic to Eocene, unconformably overlain by the fluvial sediments of Siwalik Group rocks. Several stratigraphic horizons that outcrop in the core of Surghar Anticline have proved to be potential reservoirs underneath Kohat and Potwar Foreland basin. One of such reservoirs is the Sakessar Limestone of Eocene age, which has been selected for detailed fracture analysis, as it is believed to be a potential reservoir underneath the Southern Kohat Basin where several promising surface leads such as the Karak Anticline are present. Throughout Surghar Anticline the dominant fractures orientation set observed within Sakessar Limestone include a pair of distinct opening mode followed by a shear mode conjugate pair. One of the extension mode fractures set is sub parallel to the axial trend of the Surghar Anticline that is east-northeast and the other set is oriented near-orthogonal to the fold axis that is north northwest. Shear mode joints are less prominent and have a wide variety of orientation with one prominent set, which is oriented north-northwest and north west. Fracture density calculations show that it is the greatest at forelimb followed by back limb. The fracture connectivity and porosity-permeability calculations demonstrates that various fractures at all measurement stations within Sakessar Limestone are linked to form an extended connected fractures network imparting high secondary porosity and permeability and can efficiently provide pathways for the fluids circulation. The prominent fracture network bears geometric coordination with the Surghar Anticline suggesting that their genesis is linked to the associated Surghar Anticline which itself has been evolved as a fault-propagation fold.