

## **Seismic attribute and petrophysical analysis of Dhulian area, Upper Indus Basin, Pakistan by using seismic and well log data**

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### **Abstract**

The study deals with Dhulian Area in Northern Potwar deformed zone, Pakistan. Three prominent reflectors namely R1 (Chorgali), R2 (Sakesar) and R3 (Lockhart) were marked on the seismic sections. The marked horizons show deformation in the area caused by compressional tectonics. One thrust fault cuts almost all of dipping seismic lines which was interpreted to be a Fault propagation fold. A time section was produced from the seismic section using the shot points and the two-way-times (TWT) of the reflectors and faults. The TWT was posted on the base map to make a time contour map of the Chorgali, Sakesar and Lockhart Formation as these Formations continue throughout the area, time contour maps showed major contour closures representing an anticline which is bounded by the fault on one side (fault propagation fold). Depth Maps of Chorgali Sakesar and Lockhart formation also represented an anticline with a thrust fault on one side. Seismic time and depth surfaces for three formations verified the time and depth maps representing the fault and the depth /time variations in the formations. Seismic Attribute maps help in identifying reservoir characteristics and give an idea regarding the presence of hydrocarbon. Different Seismic attribute maps including total energy map and instantaneous frequency map along with phase map were created for Chorgali, Lockhart and Sakesar Formation showing considerable variations not only in the centre but also towards north and western side of the area. With the help of these seismic attributes we identified some zones, other than zones of well, towards the north side which were yet to be explored. Well Logs of Dhulian-43 & 39 were used for petrophysical analysis. Petrophysical parameters were calculated including volume of shale, porosity, water resistivity, water saturation and saturation of hydrocarbon. Each well was analyzed formation wise and correlation between the shale volume, porosity, hydrocarbon saturation and water saturation was estimated. In Well Dhulian-39 at depth of 2643-2716meter Lockhart formation showed an increase in oil saturation with an increase in porosity, in the similar well Sakesar formation show some increase hydrocarbon saturation along with porosity at the depth range of 2475-2500meter. In Well Dhulian-43 at depth of 2633-2716meter Lockhart formation showed an increase in oil saturation with an increase in porosity, in the similar well Sakesar formation show some increase hydrocarbon saturation along with porosity at the depth range of 2600-2655meter whereas the latter part is saturated with water. On the basis of these results different zones were identified in Chorgali, Sakesar and Lockhart Formation that were feasible for hydrocarbon presence. These results were later on correlated with attribute maps resulting in identification of new probable zones. The prospective zones in the fault propagated fold of Chorgali, Sakesar and Lockhart Formation in Dhulian area were the primary targets for oil exploration which to greater extent were confirmed in this study.