

**PETROPHYSICAL ANALYSIS AND 2D SEISMIC  
STRUCTURAL ANALYSIS OF SUBSURFACE  
GEOMETRIES OF SHAKARDARA AREA, KOHAT SUB  
BASIN, PAKISTAN**



By

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BAHRIA UNIVERSITY ISLAMABAD

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This thesis submitted to Bahria University, Islamabad Campus in order to complete the requirement of the Degree of M.S in Geology.

Department of Earth and Environmental Sciences

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# Bahria University

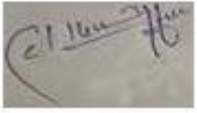
## Department of Earth & Environmental Sciences

### Islamabad Campus, Islamabad

Dated: 31/08/2021

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## **THESIS DEDICATION**

THIS THESIS DEDICATION WAS GOES TO MY BELOVED FAMILY, TEACHERS  
AND ALSO DEDICATED TO MY LITTLE CHILD.

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In the name of ALLAH the Most Merciful, the Most Gracious. I bear witness that our Holy Prophet Muhammad (PBUH) is the last Messenger of ALLAH, and his life is a best way to all mankind till up to judgments day. I am very thankful to Allah for his greater strength and support giving me during the completion of my research work. Special thanks go to my supervisor **Mr. Tausif Ahmad** for his supervision and greater support. His invaluable support and helps play a vital role in the success of my research work.

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## ABSTRACT

The study area Shakardara is situated in District Kohat, Khyber Pakhtunkhwa province, Pakistan. The purpose of the present work is to understand the petrophysical properties of the wells drilled and structural features of Shakardara area. The data used for this research work are seismic data of three dip lines 967-SHD-318, 967-SHD-319, 865-NK-12 oriented N-S direction and one strike line 967-SHD-308 oriented NE-SW direction in SEG Y format for structural interpretation and well logs data of Chanda Deep-01 well and Chanda-01 well were used for the petrophysical analysis. The seismic data and well logs data were processed and acquired by (OGDCL), Oil and Gas Development Company Limited. Petrophysical analysis is carried out with the help of (GEOGRAPHIX DISCOVERY) software while (IHS KINGDOM) software is used for seismic interpretation. The two formations of Chanda Deep-01 namely Lockhart Formation, Datta Formation, while Hangu Formation from Chanda-01 well is petrophysically interpreted. The average Vshl (volume of shale) in zone-A of Lockhart Formation is 14.36% and the effective porosity is 10.66% while the average water saturation Swa is 6.16% and hydrocarbon saturation is 93.84%. The average Vshl in zone-B of Lockhart Limestone is 13.02% and hydrocarbon saturation is 96.69%. The Vshl (volume of shale) in zone-C of Lockhart Formation is 8.61% and hydrocarbon saturation is 96.58%. The average volume of shale in zone-D of Datta formation is 5.03% while in zone-E average Vshl is 20.96% and hydrocarbon saturation is 57.47% whereas the average hydrocarbon saturation in zone-D is 54.57%. The effective porosity in zone-D is 6.40% while in zone-E phiE (effective porosity) is 5.41%. Both Lockhart Limestone and Datta Sandstone shows high net pay saturation and hence considered as an excellent producing reservoir in the area. The average Vshl (volume of shale) in zone A of Hangu Formation of Chanda-01 well ranges upto 7.70% while the effective porosity is 5.18% and the hydrocarbon saturation is 88.58% acts as a good to better producing reservoir in the well. For the seismic interpretation three reflectors and thrust faults are marked on seismic time section. The seismic interpretation confirms that thrust fault propagation fold is present in the area which leads to compressional tectonic regime. Seismic section shows that structural traps are present in the area which is best for the accumulation of hydrocarbon. Both time and depth contour maps are generated which shows thrust anticlinal structure. Seismic interpretation confirms that both wells are drilled on thrust anticlinal structure.

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## **LIST OF ABBREVIATIONS**

## **B**

BHT- Bore Hole Temperature

## **D**

DGPC (Directorate General of Petroleum Concessions)

## **F**

FT- Formation Temperature

## **L**

LLS- Laterolog Shallow Resistivity

LLD- Laterolog Deep Resistivity

## **M**

MBT- Main Boundary Thrust

MSFL- Micro-Spherically Focused Log

## **P**

$\phi_{\text{PhiN}}$ - Neutron Porosity

$\phi_{\text{PhiD}}$ - Density Porosity

$\phi_{\text{PhiA}}$ - Average Porosity

$\phi_{\text{PhiS}}$ - Sonic Porosity

$\phi_{\text{PhiE}}$ - Effective Porosity

## **R**

Rmf1- Resistivity of Mud Filtrate at Surface Temperature

Rmf2- Resistivity of Mud Filtrate at a Depth

Rmf<sub>eq</sub>- Resistivity of Mud Filtrate Equivalent

R<sub>w</sub><sub>eq</sub>- Resistivity of Water Equivalent

Rw- Resistivity of Water

## **S**

Sh- Hydrocarbon Saturation

Swa- Saturation of Water

SSP- Static Spontaneous Potential

## **T**

TS- Surface Temperature

## **V**

Vshl- Volume of Shale