Ain Shams University

Faculty of Science

Geophysics Department

# 3D Seismic Inversion and Attributes of Hydrocarbon Plays at South West Abu Sennan Field, Abu Gharadig Basin, Northern Western Desert of Egypt

A Thesis submitted in Partial Fulfillment for the Requirements of the Master Degree in Geophysics

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# NOTE

The present thesis is submitted to Faculty of Science, Ain Shams University in partial fulfillment for the requirements of the Master degree of Science in Geophysics.

Beside the research work, which is materialized in this thesis, the candidate has attended ten post-graduate courses for one year in the following topics:

l- Geophysical Field Measurements.
2- Numerical Analysis and Computer Programming.
3- Elastic Wave Theory.
4- Seismic Data Acquisition.
5- Seismic Data Processing.
6- Seismic Data Interpretation.
7- Earthquake Seismology.
8- Engineering Seismology.
9- Deep Seismic Sounding.
10- Structure of the Earth.

He successfully passed the final examinations in those courses. Concerning the language requirement of the degree, He also passed the final examination of a course in English language.

Head of Geophysics Department

**Prof. Dr. Salah Eldin Abdel Wahab Mousa**

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# ABSTRACT

The Western Desert (WD) is classified as a one of the most important oil and gas provinces in Egypt. Many discoveries have confirmed the economic potential of this province, such as Southwest Abu Sennan (SWS) field, which is the area of interest in the present study. SWS development lease is located at the central southern part of Abu Sennan area, 300 km. west of Cairo and around 150 km. south of EL-Dabaa Mediterranean North coast, front town. It covers a range of approximately 100 km². and delineated by latitudes 29°32' to 29°35' N, and longitudes 28°30' to 28°35' E. SWS structure was discovered by the General Petroleum Company (GPC)–1985.

In this study, to delineate the optimum interpretation of seismic data and minimize the uncertainties, different attributes were extracted from the available seismic data in order to highlight the main faulting pattern trends and to enhance seismic reflector continuity. Structural interpretation is considered a conventional method for oil exploration and commonly used. The use of unconventional methods could lead to achieve significant results and reduce the drilling risk. Seismic Inversion was applied in order to find if there is a relation between the presence of hydrocarbon and seismic impedance data or not, seismic data is not a true amplitude recovery data.

Four stratigraphic-control wells and seismic data were available for this study, volumes between 952 and 2000 mSec. were inverted for P-impedance and Density. The products of the Post-stack seismic inversion were proven a useful technique for the subsurface interpretation, where the hydrocarbon reservoirs geometry was clearly imaged.

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# 3. Seismic Data Interpretation and Attributes



# 4. Post-stack Seismic Inversion

# LIST OF ABBREVIATIONS

| | |
|---|---|
| GPC | The General Petroleum Company |
| SWS | Southwest Abu Sennan |
| WD | Western Desert |
| AR | Abu Roach |
| Fm. | Formation |
| TDR | Time depth relationship |
| m. | Meter |
| km. | Kilometer |
| CI | Contour Interval |
| mSec. | Millisecond |
| ETM | Egyptian Transverse Mercator |
| VSP | Vertical Seismic profile |
| TWT | Two-way travel time |
| F/O | Faulted out |
| Hz | Hertz |
| kHz | Kilohertz |
| $V_P$ | P-wave velocity |
| $V_S$ | S-wave velocity |
| AI | Acoustic impedance |
| RC | Reflection coefficient |
| $Z_p$ | P-wave impedance |
| GR | Gamma Ray Log |
| VSS | Vertical Subsea |
| ρ | Density |
| V | Velocity |

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