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ROCK PHYSICS MODELING AND SEISMIC INVERSION APPLICATIONS FOR THE GAS- BEARING SAND CHARACTERIZATION, SIMIAN FIELD, MEDITERRANEAN SEA, EGYPT.

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

1. Geophysical field measurements
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6. Reservoir Evaluation
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8. Geophysical Prospecting
9. Sedimentary Basin Analysis
10. Fluid Dynamics

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Abstract

The first part of this thesis focuses on carrying out a detailed petrophysical analysis of the well-logs to determine the porosity (ϕ), water saturation (S_w) and lithology (V_{sh}). This is followed by analyzing the well-logs in order to identify the reservoir zones. These reservoir zones were analyzed for lithology and fluid saturation effects using rock physics analysis. Results from applying rock physics analysis clearly showed fluid response. The next step involved investigating a corresponding response on seismic data i.e. if the fluid response can also be seen on seismic data. In doing this, seismic to well ties are carried out to match reservoir zones identified in the well-log data to the seismic data. Synthetic gathers (0-45 degrees) are generated for each well for different fluid scenarios.

This is followed by evaluating some rock-property models using well-log data from the study area: Cement, Friable and Trend-based model. These models were used in reconstructing P-wave logs, S-wave logs, and density logs.

Well-log inversion is also carried out. From this result, density and elastic moduli of the individual rock constituents is estimated by minimizing the difference between modeled and measured sonic logs (P-wave and S-wave) and density.

Reservoir rock parameters obtained from rock physics modeling are only known at well locations, but we seek to propagate these parameters everywhere on the reservoir in the survey area. So, the last phase of the thesis involves the integration of the results from both seismic and rock physics modeling in a joint inversion based technique to propagate reservoir parameters to include areal extent of the reservoir and to see how this varies within the field.

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