Geology Department
Faculty of Science
Ain Shams University

Structural mapping in the southern part of the Gulf of Suez (Egypt) using seismic attribute analysis

A Thesis Submitted to
Ain Shams University, Faculty of Science,
Geology Department

In Partial Fulfillment of the Requirements for the Degree of Master of Science in Geology
By

Nesma Sayed Ismail Behery
B.Sc. 2011

Supervised by

Prof. Dr. Adel Ramadan Moustafa
Professor of Structural Geology
Faculty of Science
Ain Shams University

Dr. Mohamed Yousef Rizk
Lecturer
Faculty of Science
Ain shams University

Dr. Hatem Farouk Ewida
Exploration General Manager
Tri Ocean Energy
Nospco JV

Geology Department
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Approval Sheet

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Supervisors **Approved**

Prof. Dr. Adel R. Moustafa
Professor of Structural Geology …….
Geology Department, Faculty of Science
Ain shams University.

Dr. Mohamed Yousef Rizk
Lecturer, Geology Department ...…….
Faculty of Science
Ain shams University.

Dr. Hatem Farouk Ewida
Exploration General Manager …….
Tri Ocean Energy**,** Nospco JV.

Prof. Dr. Ali Farrag Osman

.....

Chairman of Geology Department

Note

This thesis is submitted to the Faculty of Science, Ain Shams University in partial fulfillment for the requirements of the Master of Science in Geology. Besides the research work materialized in this thesis, the author did attend eleven post-graduate courses for one academic year in the following topics:

1. Advanced Structural Geology
2. Geotectonics
3. Field Geology
4. Geostatistics
5. Geomorphology
6. Photogeology
7. Sedimentary Petrology
8. Sedimentation
9. Advanced Lithostratigraphy
10. Biostratigraphy
11. English Language

She successfully passed the final examinations in these courses held in September 2013.

Prof. Dr. Ali Farrag Osman

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Chairman of Geology Department

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I am grateful to **the Gulf of Suez Petroleum Company (GUPCO)** and **the Egyptian General Petroleum Corporation (EGPC)** for releasing the subsurface data used for this study.

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Finally, I would like to present this work for my **Mother** and my daughter **Rodina Yassen**.

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Abstract

Sidki field is one of the B-trend oil fields located in the southern part of the Gulf of Suez, Egypt. The Gulf of Suez acquired its importance from having hydrocarbon resources. It is described as an elongated depression (325km long) separating Sinai Peninsula from Africa. It also represents one of the most intensively faulted areas of Egypt, which is dominated by major normal faults trending NW-SE and tilted fault blocks with sedimentary fill up to 6 km thick.

The quality of the seismic records in the southern part of the Gulf of Suez is generally poor due to the presence of thick evaporitic sequence in the Upper Miocene. Hence, the use of coherence seismic attribute will be an effective tool in visualizing the trends of faults, which are not visible in seismic amplitude information. It worth mentioning that the coherence seismic attribute analysis technique, used in this study, is applied for the first time in the Gulf of Suez.The main objective of this study is to identify and delineate the possible subsurface structures of the area through the use of seismic attributes. The methodology combined conventional interpretation of 3D seismic data of the study area and then analyzing the coherence seismic attributes of the same 3D seismic dataset to enhance the fault interpretation.

The conventional interpretation of the 3D seismic data reveals that Sidki field is a SW dipping tilted fault block dissected by normal faults into several compartments. Two different fault trends affected Sidki field, major NW-SE Gulf of Suez trend and minor NNE-WSW cross fault trend.

Other new normal faults interpreted after applying the technique of coherence attribute analysis. These faults are also trending NW-SE and dipping toward the NE.

Keywords: Sidki field, subsurface structures, conventional interpretation, coherence seismic attribute.

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Introduction

1.1 Location of the study area

Sidki field lies in the southern part of the Gulf of Suez. It is located 12km from the western shoreline and 8.75km NW of East Zeit field (Fig. 1.1).

The field is operated by the Gulf of Suez Petroleum Company (GUPCO) which is a joint venture Company between the Egyptian General Petroleum Corporation (EGPC) and British Petroleum Production Company (BP).

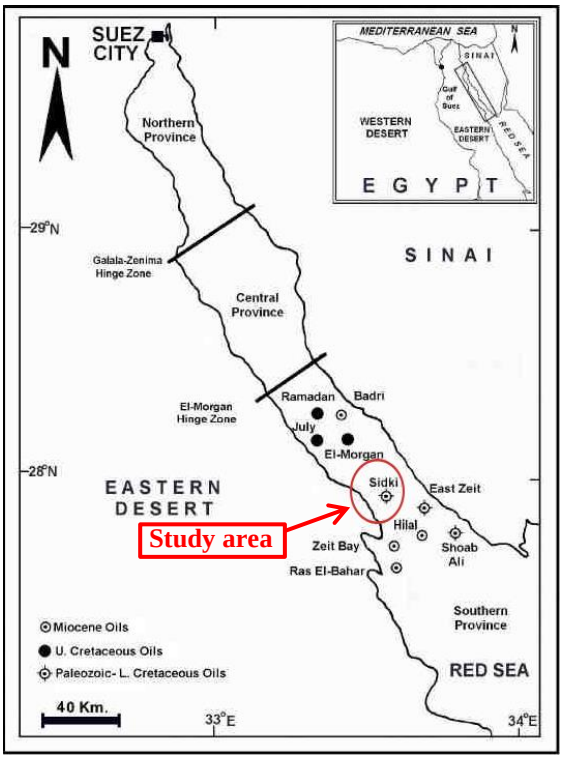

Fig. 1.1. Location map of the study area.

Sidki field appears to be a southwest dipping tilted fault block which dips about 30˚-32˚ at the Nubia level and 10˚-12˚ at Kareem level (Fig. 1.2).

Seismic data indicate a regional NW-SE trending structure with SW dipping faulted blocks and associated with an overlying salt section.

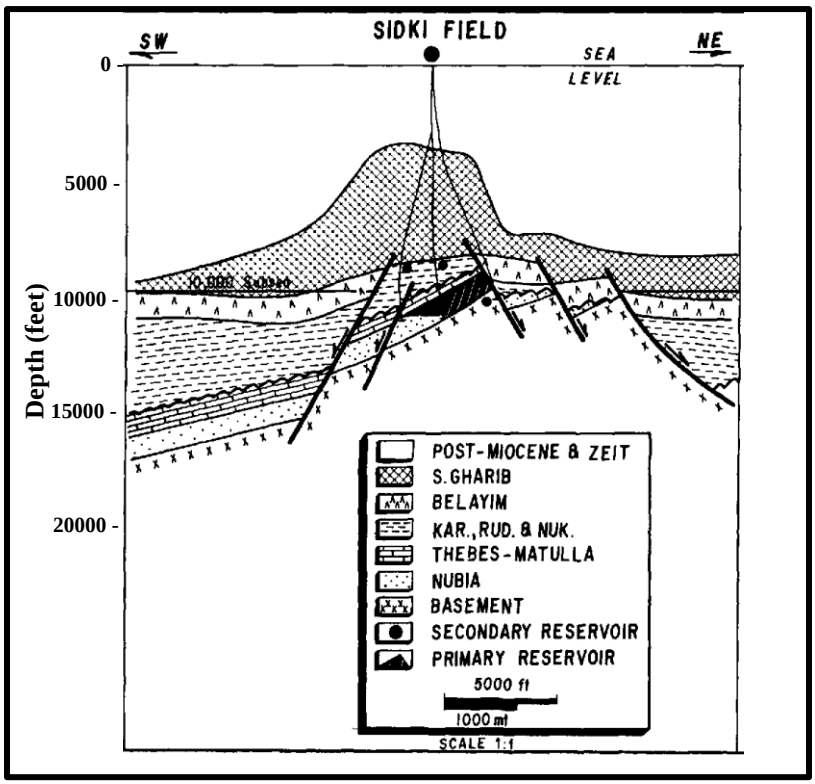

Fig. 1.2. Structural cross section across Sidki field (after Helmy, 1990).

1.2 Objective

The main objective of this study is to identify and delineate the possible subsurface structures of Sidki field, south Gulf of Suez.

In order to achieve the objective of the present study, the following workflow was followed:

a. Reviewing the general geologic setting of the southern part of the Gulf of Suez rift with particular emphasis on the study area.
b. Conventional interpretation of 3D seismic data of the selected area using decision space R10, 0, 05 software of Halliburton for interpretation and mapping.
c. To demonstrate the structures, depth-structural map of the interpreted horizon has been constructed.
d. In order to enhance the fault interpretation, interpretation of 3D seismic data of the same area using coherent attribute analysis has been done.
e. Another depth-structural map has been constructed for the interpreted horizon after using the attribute analysis technique.

1.3Database and Methodology

The data used in this study include wire line logs of four wells drilled in the study area, 3D seismic volume and coherence attribute volume (Fig. 1.3). The four wells are SDK-9A, SDK-B1ST1EXP, GS 381-1 and SDK B1 DEV. The seismic data covers an area about 31km^2. All of the used data were imported into interactive workstation. The seismic lines are in-lines shot perpendicular to the dip direction while the cross-lines are shot perpendicular to the strike direction of the rift-bounding faults. The interpretation was carried out using decision space R10, 0, 05 software. The logs used in the study include dipmeter, gamma ray, resistivity and density logs. These data were supplied by the Egyptian General Petroleum Corporation (EGPC) and the Gulf of Suez Petroleum Company (GUPCO).

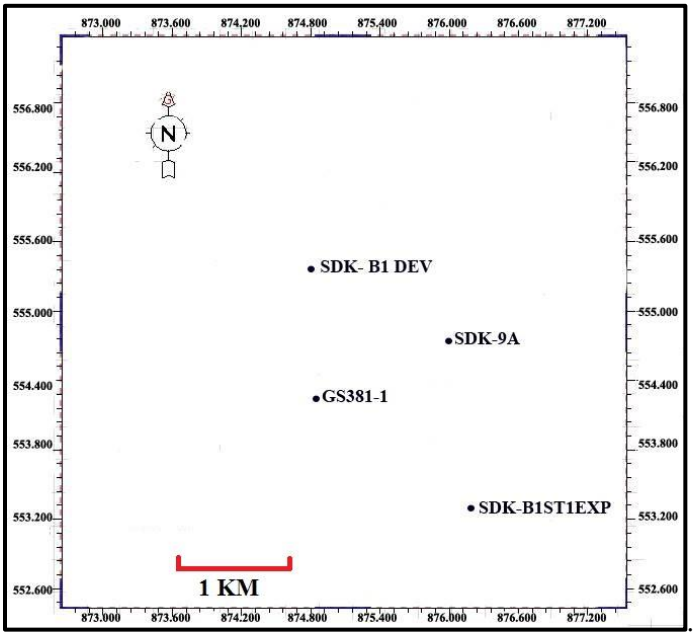

Fig. 1.3. Base map of the seismic cube used for the study.
Four wells are only used in this study.