Ain Shams University
Faculty of Science
Geology Department

Structural Setting and Reservoir Characterization of Syn-Rift Facies, West Gebel El-Zeit Area, Gulf of Suez, Egypt

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

For the degree of Doctor of Philosophy in
Geology

BY
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B.Sc. in Geology, Cairo University (1987)
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Approval Sheet

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Abstract

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The study area including Al Amir and Geyad oil fields (onshore Northwest Gemsa) is located in west Gebel El Zeit area, covering an area of about 39 km^2 & 26.4 km^2, respectively. The study covers the PetroAmir, Geyad and Al Amir concessions and is based on 2D seismic data and nine wells (Shehab-1X, Geyad-2X, Geyad-1X, Al Amir SE-1X and st, Al Amir SE-2X, Al amir SE-3X, Al Amir SE-4X, Al Amir SE-5X and Al Amir SE-6X). The study is aimed to highlight the reservoir characterization and structural configuration of the syn-rift facies.

The study examines the selected nine wells in which the penetrated Miocene stratigraphy from bottom to top section includes; Nukhul, Rudeis, Kareem and Belayim formations. The Nukhul Formation is recorded only in Geyad-2x, Al Amir SE-1x, Al Amir SE-1xSt wells but it is not recorded in other wells due to incomplete drilling. The faults in the study area are dip-slip faults of NW-SE trend. Four major NW-SE trending normal dip-slip faults are picked (F1, F7, F10 and F12). These parallel clysmic faults produce tilted fault blocks with dip direction toward the SW. These clysmic faults dissect all the syn-rift section (from Nukhul to Zeit formations) except F12 which dies out in the Rudeis Formation. F2 and F8 faults are NW-SE trending secondary normal faults with downthrow toward the NE direction (antithetic faults). In addition, there are some cross faults oriented NE-SW, which bound the reservoir blocks.

There are five wells that have cores in the Kareem Formation. The different lithofacies are derived from the study of the sedimentary sequences of Kareem Formation in the five cored wells. These wells are Al Amir-3X St2, Al Amir-4X, Al Amir-5X, Al Amir-6X and Geyad-2X. The study revealed the recognition of four

main facies groups, divided into 13 sub facies. Generally, the cored intervals represents cyclic alternations of hemipelagic sedimentation with dominance of carbonate and mudstone facies interrupted by some debris flow pulses with deposition of massive sandstones and conglomerates (stratified sandstone turbidities). The cored intervals of the five cored wells represent a part of distal submarine lobes in open-deep marine setting . The reduced sand thickness and the dominance of hemipelagic facies indicate the deposition in a distal setting away from the main bounding source. The reservoir units do occur mainly in the main facies (Gm, Sm and Sh).

In the present work the wireline logs, especially Gamma Ray logs are used in the application of the cyclolog® software to build a cyclicity pattern of the nine study wells. The penetrated section is distinguished into six main 3rd order sequence stratigraphic cycles. Cycle 2.4 represents the Kareem Formation of the study interval.

The interpreted 2D seismic data, electrical logs from nine wells and core data from five wells were used to construct a 3D static model for the different blocks of Al Amir and Geyad fields. These main fields are subdivided into 2 blocks and the main reservoirs is within the Kareem Formation.

Key words: Gulf of Suez rifts, Al Amir and Geyad oil fields, West Zeit Basin, Cyclicity, cross faults.

List of Abbreviations

Ahnl	Laminated anhydrite
Ahnn	Nodular anhydrite
BHC	Compensated sonic log
BVW	Block volume water
CALI	CALIPER log
Cl/Cm	Marls
Cm/Cl	Laminated / massive carbonate/marl
CNL	Compensated Neutron log
EMF	Esh El Mellaha Fault
FVF	Formation Volume Factor
Gm	Massive conglomerate
GR	Gamma-ray log
INPEFA	Integrated Predictive Error Filter Analysis
LLD	Dual-Laterolog (deep)
LLS	Dual-Laterolog (shallow)
Ma	Million annum
MD	Measured depths
Ml	Laminated siltstone/Mudstone
Mm	Calcareous Shales
MSFL	Microspherically Focused
NPHI, TNPL, APLC	Neutron porosity
PE	Photo electric log
PEFA	Predictive Error Filter Analysis
PHIE	Effevtive porosity
RBF	Rift boundary fault
RHOB, RHOZ, SBED2	Bulk density
Rmf	Mud filtrate resistivity at formation temperature
Rw	Formation Water Resistivity
Rweq	Equivalent water resistivity
Sgm	Massive pebbly muddy Sandstone
Sh	Stratified Sandstone
Si	Inverse graded Sandstone
Sm	Massive pebbly Sandstone

Sm1	Massive Sandstone
Sm/Gm	Normal graded pebbly Sandstone / Conglomerate

SSP	The static self potential
STOIIP	Static Oil Initial In Palce
Sw	Water Saturation
TD	Total drilling depth
TVDSS	True vertical subsea depth
TVT	True vertical thickness

Log Tacks

Track 1	Represents the Formation name.
Track 2	Contains the GR, SP, CALI logs.
Track 3	Depth track, pay flag (pay zone indicator) and reservoir flag (reservoir zone indicator).
Track 4	Represents the cyclostratigraphic units.
Track 5	Represents the subcyclostratigraphic units.
Track 6	INPEFA cyclicity log patterns.
Track 7	Resistivity logs
Track 8	Neutron, Density and photo electric logs (NPHI, RHOB and PE).
Track 9	Sonic log.
Track 10	Curve of hydrocarbon and water saturation (Sw).
Track11	Effective porosity (PHIE) and bulk volume of water (BVW).
Track12	Volume of lithotypes (sand, shale, limestone, and anhydrite, etc.).

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