[PS]Role and Contribution of Facies Development and Depositional Model in Maximizing Economic Recovery from Hydrocarbon Bearing Carbonate Reservoir, Ras Fanar Field, Gulf of Suez, Egypt*

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Abstract

Depositional system reorganization and facies development play an important role in defining the details distribution of reservoir rocks and fluid content with the ultimate goal of a reservoir management scheme. This reorganization aims to provide facts and information necessary to control production operations and to optimally develop any oil or gas field by obtaining the maximum possible economic recovery from the reservoir units. Also, it helps in the reservoir characterization modeling process which embodies the integration of the technical disciplines of the exploration and the development phase.

This study describes the Carbonate Reservoir Depositional Model of Ras Fanar Field (as one of the oil fields which produce hydrocarbons mainly from carbonates of Middle Miocene age), Gulf of Suez, Egypt.

Sedimentological, petrographical and petrophysical data in addition to microfacies associations and diagenetic examination were used to follow up the development history and reservoir characterization. Test results and production data of the drilled wells are also used to develop a better understanding of reservoir dynamics and to improve the depositional model of the reservoir aiming to predict the content and the production behavior of wells in order to formulate a plan for the development of the carbonate reservoir in the field.

Role & Contribution of Facies Development & Depositional Model in Maximizing Economic Recovery from Hydrocarbon Bearing Carbonate Reservoir.

Ras Fanar Field, Gulf of Suez, Egypt

Wegdan Saleh Khalaf Abd El-Aal

AAPG International Conference & Exhibition

SUCD

A Abstract

- Facies Development and Depositional System Recognization Plays an Important Role in Defining The Details Distribution of Reservoir Rocks & Fluids Content which is The Ultimate Goal of a Reservoir Management .This Recognization Aims to provide Facts & Information Necessary to Control Production Operations & to Optimally Develop any Oil or Gas Field by Obtaining The Maximum Possible Economic Recovery from The Reservoir Units. Also, it helps in The Reservoir Characterization Modeling Process Which Embodies The Integration Of The Technical Disciplines of The Exploration & The Development Phase.
- This Study describe The Carbonate Reservoir Depositional Model of Ras Fanar Field (as one of the Oil Fields which produce Hydrocarbons Mainly from Carbonates of Middle Miocene age), Gulf of Suez, Egypt.
- Sedimentological, Petrographical & Petrophysical data in addition to Microfacies Associations & Diagenetic Examination were used to follow up The Development History & Reservoir Characterization.
- Test Results & Production Data of The Drilled Wells are also used to develop a better understanding of Reservoir Dynamics & to improve The Depositional Model of The Reservoir. It was Aiming to predict The Content & The Production Behavior of Wells in order to formulate a plan for The Development of The Carbonate Reservoir in The Field.

B Objectives

- To Demonstrate How Different Geological and Geophysical Data can be integrated to recognize The Facies Development and Depositional Environment for The Carbonate Reservoir.
- Describe the Depositional Model of Carbonate Reservoir, Ras Fanar Field, to be Integrated into Static Model to be used as part of the input required to construct the 3D Dynamic Model Aiming to:-

1. Maximized Profitability from the Hydrocarbon Reservoir units.
2. Identify and Model of Carbonate Reservoir using concept Depositional sequences that Predict the content and production behavior of wells.
3. Explain the past carbonate Reservoir performance and Formulate Planes for Development of the carbonate.

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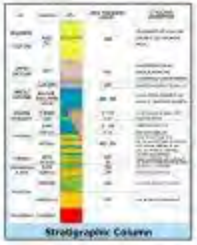
C Introduction

Field Highlights

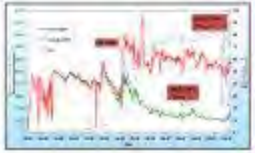
Ras Fanar Oil Field is located in The Western Offshore, Gulf Of Suez Area Some 3.5 Km. East of Ras Gharib City in a Water Depth of About 100'.


Stratigraphic Column

Stratigraphic Sequance

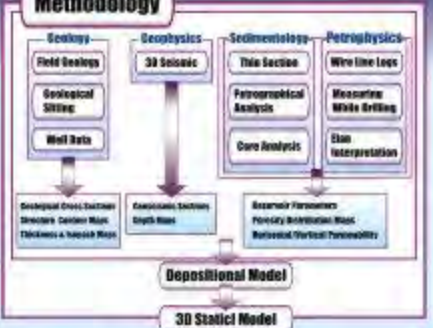
- The Miocene & Younger Stratigraphic Sequence Relevant To Ras Fanar Field Is Shown In The Stratigraphic Column.
- The Main Production Zone in Ras Fanar Field Is The Nullipore Carbonate.
- The Nullipore Carbonates Occur Below The Evaporate Of South Gharib Formation.
- The Nullipore Is Considered To Be Shallow Marine Facies Of Nonconformable Member Of Belayim Formation.
- These Carbonate Overly Various Pre - Miocene Strata.

Field Performance



- 1984 production started naturally with traces of water.
- 1984-1993 stable production rate ± 30000 BOPD with traces of water.
- 1993-1995 production rate dropped to 8000 BOPD (no drilling activity)
- 1996 started ESP project; the production rate maintained to 15000 BOPD (40% - 70% wc).
- 2003 PRODUCTION dropped to 6000 BOPD.
- 2004-2006 West Ras Fanar developement phase1 (6 Wells) increase the production by ± 4000 BOPD.
- 2006-2009 production rate dropped to 3500 BOPD (no drilling activity).
- 2010 West Ras Fanar development phase 2 (5 well) increase the production by ±4500 BOPD.
- Total production rate ± 7500 BOPD.

Methodology



D Field Geology

Type Section of "Nullipore" (About 130 m Thickness) is Represented in Wadi Gharandal Area (Western Side Of Sinai Penisula).

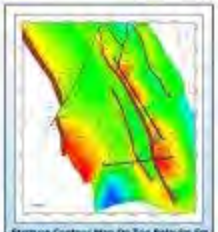
Type Section Reflects The Shallow Marine Warm Water Conditions That Favorable for Reefal Development.

This Carbonate reveal A Multi-Scale Heterogeneity System.

To Understanding how to deal with our Reservoir it must be Investigate The Surface Outcrop.

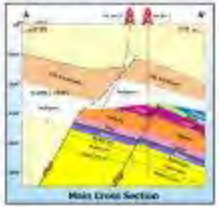
It is proved that The Structure Setting , some Facies & Coralline Algae are similar to those present in Gebl El Maiaita, Gulf of Suez.

E Geological Sitting


Structure Contour Map On Top Belayim Fm

The Ras Fanar Structure is An narrow Elongated Horst Blocks Trending NW - SE (Gulf of Suez Trend) & Tilted to NE.

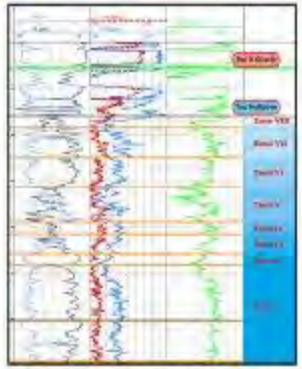
The Structure is Dissected By Several Aquaba Trending Cross Faults.


Main Cross Section

Ras Fanar Was Discovered in 1978 by The Exploratory Well RK 84-1.

The Well Penetrated 400' of Oil Bearing Carbonate Of Belayim Fm " Nullipore "

F Electrolithofacies Zones

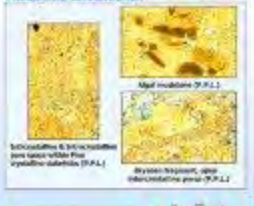


- Zone VIII: Sandy mudstone to wackestone (biomicrite)
- Zone VII: Molluscan Dolomitic packstone (molluscan biomicrite)
- Zone VI: Possilliferous packstone to boundstone (algal biomicrite)
- Zone V: Deeply-weathered dolomitic wackestone to packstone (biomicrite)
- Zone IV: Possilliferous dolomitic wackestone to packstone (biomicrite)
- Zone III: Anhydritic fossiliferous packstone to boundstone (algal biomicrite)
- Zone II: Anhydritic dolomitic wackestone to packstone (algal biomicrite)
- Zone I: Anhydritic fossiliferous packstone (biomicrite)

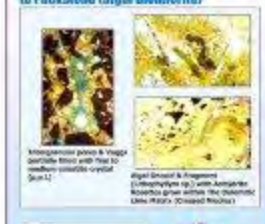
Sedimentology & Petrography

A Lithofacies Zones

ZONE I : Anhydritic Fossiliferous Packstone (Biomicrite)



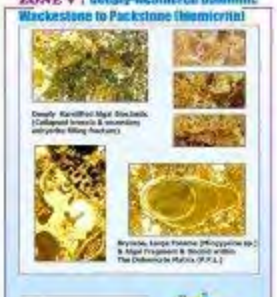
ZONE II : Anhydritic Dolomitic Wackestone to Packstone (algal Biomicrite)



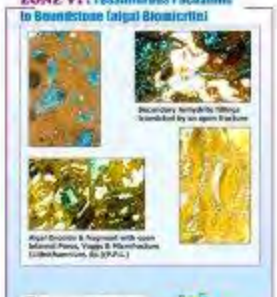
ZONE III : Anhydritic Algal Packstone to Boundstone (algal Biomicrite)

ZONE IV : Fossiliferous Dolomitic Wackestone to Packstone (Biomicrite)

ZONE V : Deeply-weathered Dolomitic Wackestone to Packstone (Biomicrite)



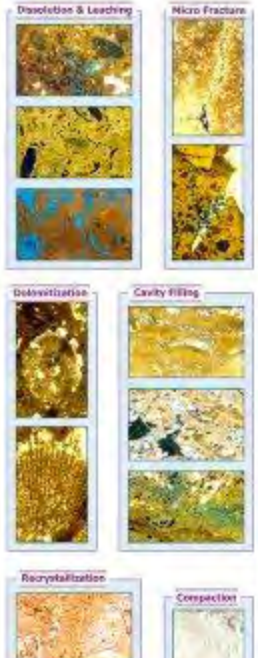
ZONE VI : Fossiliferous Packstone to Boundstone (algal Biomicrite)



ZONE VII : Mollusc Dolomitic Packstone (Mollusc Biomicrite)

ZONE VIII : Sandy Anhydritic Mudstone to Wackestone (Biomicrite)

B Diagenesis



C Porosity Types

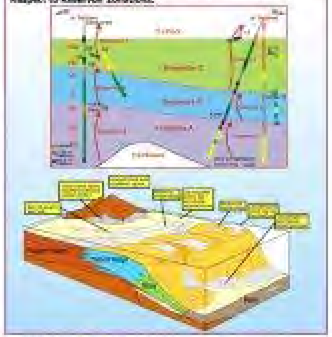
D Facies Associations

Results

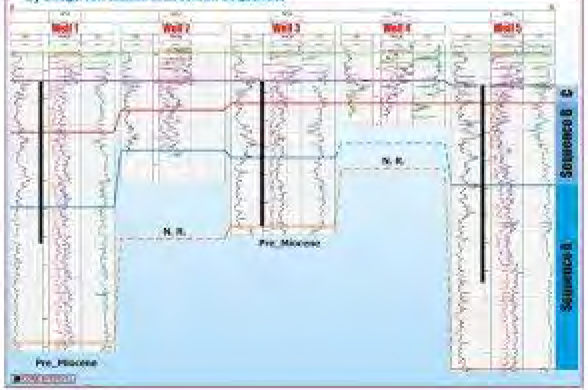
A Reservoir Sequence Zonations

1.) FACIES MODEL

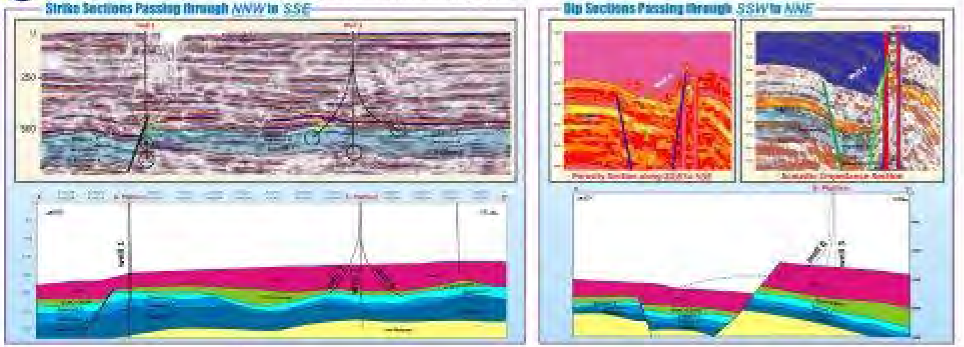
NW - SE Sketch Section To Illustrate Appropriate Location Of Cored Sections, Facies Associations & Depositional Sequences A, B & C with Respect to Reservoir Zonations.



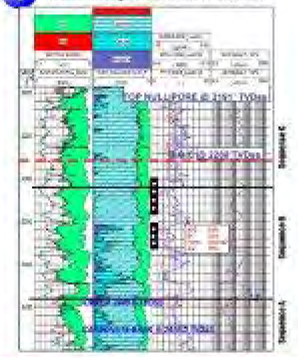
2) E-Logs Correlation of Reservoir Sequences



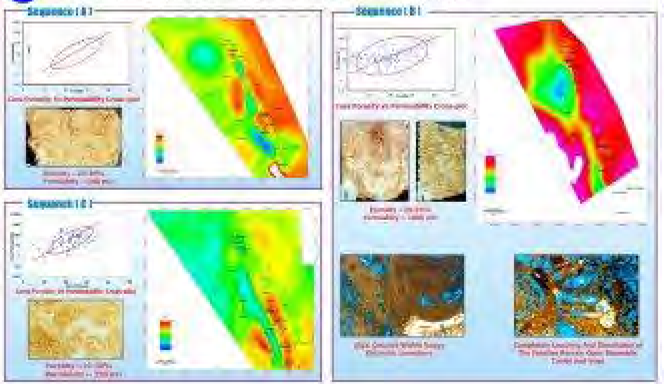
B Seismic & Geological Cross Sections for Reservoir Sequences



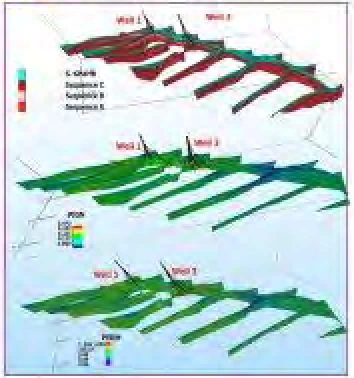
C Elan Interpretation for Well 6



D Isochore Maps & Core Analysis Of Reservoir Sequences



E 3D Static Models



Summary & Conclusion

- The Nullipore Reservoir Is Divided Based On The Petrographical And Sedimentological Evaluation Into 8 Lithofacies Zones, That Represent More Or Less Successive Sedimentary Cycles. Log Response Indicates Good Correlation Between These Lithofacies Zones Along The Field.
- Detailed Petrographic Examination Of The Nullipore Carbonate Show Several Diagenetic Process That Largely Effect The Reservoir Properties And Heterogeneity.
- Facies Associations Indicate A Relatively Low Energy , Mud Dominated Peritidal Region Passing Seaward To A Platform Interior Area Of Muddy Lime Sands, Lime Muds And Then To A More Open Marine Outer Platform Region. Facies Association Reveal That The " Nullipore " Depositional Environment Can Be Subdivided Into Peritidal, Inner And Outer Platform Environments.
- Based On The Lithofacies Characteristics , Flora Contents And Structural Setting, The Nullipore Facies Is Divided Into 3 Regressive Sequences From Bottom To Top Are A, B And C.
- Environmentally, The "Nullipore" Sequence Is Of Proper Marine Conditions Suitable For Reef And The Diagenetic History Reflects Main Role Of The Fluctuations In The Hydraulic Meteoric / Marine Interfaces.
- Zone B Has The Best Production Performance.

Recommendation

- Surface Geology (Outcrops) Investigation Of The Interested Area Is Highly Recommended For The Analogue With The Subsurface Data.
- Detailed Seismic Stratigraphy As A Supported Tool Beside To The Petrographical And Sedimentological Description Will Give Best Zonation.
- Sequence B Is Highly Recommended To Get Highly Production Performance.

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