Petroleum Systems of the Levant

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Eastern Mediterranean: What’s with the Perception?

- Security Issues
- Only Deep Expensive Gas left
- Poor Well Results
- Commercial Issues
Game Changer in the Levant

Zohr Discovery
South Levantine Basin: Gas Basin?

**Tanin**
2011 Gas Discovery, 130ft net pay
Lower Miocene ‘Tamar’ sands.
Reserves: Mean 1.1 TCF

**Aphrodite**
2011 Gas Discovery
310ft net pay
Miocene sands
Reserves: Mean 7 TCF

**Leviathan**
2010 Gas Discovery
220ft net pay
Lower Miocene sands
Reserves: Mean 17 TCF.
*Reported deeper thermogenic gas zone at 21,000ft

**Shimsom**
2012 Gas Discovery
Reserves: Mean 1 TCF.

**Tamar**
2009 Gas Discovery 2012 onstream
460ft net Mid-Lower Miocene sands
Reserves Mean 9 TCF

**Dolphin**
2011 Gas discovery
‘Tamar’ sands
Reserves: Mean ca 0.5 TCF

**Dalit**
2009 Gas Discovery
Lower Miocene Sands
Reserves: Mean 0.5 TCF
So what do we know about the Levant Basin?

1. Biogenic Gas Play in deepwater
2. Locally derived reservoir of poor quality
3. Complex, strike-slip structures.

All suggesting difficult reservoirs, gas, hard to develop and long lead time to production.

I don’t think any of the above is true
Early Miocene Reservoir thickening to the north

Line length 220 km

KEY
- Top Messinian
- Base Messinian
- Lower Miocene
- Oligocene
- Turonian

S Tamar N
1. RESERVOIR:
Paleo - Reconstruction

Cretaceous: Tethys open to east
Nile River Drains into “Niger” Delta

Eocene Restricted
Nile Delta Establishing

Late Miocene
Closed

Open Sea way

After Robertson 1998
Geometry of Basin System E. Miocene

- Nile: Prograding Deltaic Packages
- Southern Levant: Deep Marine Clastic Transport systems
- Northern Levant: Basin Floor Depocenter
- Eastern Levant: Pinch out onto Basin margin

- SW to NE: 260Km
- 290 km 2D line
- 50Km

Blocks:
- Block 5
- Block 6
Early Miocene sand input from Arabian Plate?

Afiq canyon insising into Early Miocene 
le post-dating Early Miocene sand influx 
Therefore not the source for Early Miocene sands 
That fill the northern Levant basin
Zohr Seismic / Geoseismic

E MIOC NILE ISN’T FLOWING NORTH…
Isochore (TWT interval) Map of the Early Miocene

Orange = top Early Miocene
Yellow = base Early Miocene

Top Early Miocene Sands

Lebanon
Tannin
Lebathan
Temai 61
Dail 1

TWT interval

Map
Sand falls into the N Levant Basin...
Does Any Sand NOT fall into the N Levant Basin...
Amathusa-1

Very thin interval block 9:

Thick sand in Block 5 lebanon
ENE – WSW line along strike N LEVANT Basin

- Top Early Miocene Sand
- Lower Miocene Sands Ca 1000m thick
- Top Lower Miocene Structures 400m Relief
Deepening Basin into Lebanon: More chance of Oil

Oligocene source: biogenic gas offshore Israel, Zohr, Yet, N Levant more deeply buried.
2: Charge

3D Basin Modelling: South to North Levant

Source Rocks

1. Miocene
2. Oligocene
3. Eocene
4. Campanian
5. Cenomanian
6. Early Cretaceous
7. Jurassic
8. Triassic
Independent basin modelling & seeps

Levant Basin, 25°C/km

CONCLUSIONS on PETROLEUM SYSTEMS
U. Cretaceous Thermogenic System

High Potential for Oil, Biogenic and Thermogenic Gas

? Southern Levant Basin, 15°C/km
South Levantine Basin: All biogenic Gas?

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**Shimsom**
2012 Gas Discovery
Reserves: Mean 1 TCF.

**Karish**
2013 Gas Discovery
180ft net Lower Miocene sands
Reserves mean 2-3 TCF

**Tamar**
2009 Gas Discovery **2012 onstream**
460ft net Mid- Lower Miocene sands
Reserves Mean 9 TCF

**Dolphin**
2011 Gas discovery
‘Tamar’ sands
Reserves: Mean ca 0.5 TCF

**Dalit**
2009 Gas Discovery
Lower Miocene Sands
Reserves: Mean 0.5 TCF
Karish Well

EM 0046
West-east

EM 007
South-North

Early Miocene strongly pinching out onto in Margin

No E Mio Sands

Early Miocene pinch out: this is a stratigraphic play!
Early and Late Miocene Playfairways
Proven in Tamar,
Leviathan, Dolphin,
Tannin, Dalit, Aphrodite
Shimson, Karish, Mari B,
Noa, Gaza Marine, Or, Nir.

Offshore nearer to shore but still very deep water:
Cretaceous and Jurassic carbonate Play-fairways
Southern Levant and North Sinai.
IEOC’s line published a few years ago over zohr
Line on edge of Zohr discovery

10kms

(100kms²)
30TCF

Lagoonal Facies?

Messinian Evaporites

Oligo-Miocene

Reefs

Cretaceous

WSW

ENE
North of Zohr

SSE

20kms

NNW

Zohr Look Alike? (+500 km²)
Eratosthenes Sea Mount

Herodotus Basin  Early Miocene  Northern Levant Basin
Crustal Model

Gravity Profile

Oceanic Crust

Tethyan

Sinai-Levant Margin

North Africa Plate

Arabian Plate

Oceanic Attenuated Crust
Zohr Look-alikes Ringing the Seamount

WSW | Total block 10 | ESE
---|---|---
Total block 11 | NE of Zohr

2011 PSTM
3: Structure

Structures In South Lebanon

2D regional Line
Line length 220 km

S Tamar N

Extensional structures SW Lebanon far less complex than compressional structures S Levant
Structures North and South Levant Basin

Both Images are at identical scales

Ref: Noble Website

Phoebe

Leviathan
Structures North Levant Basin
After Kosi, Tari, Nader, Skiple, Trudgill and Lazar, 2012
Southern half-block 5
Phoebe Structure, Mapped at Top Langian

Crest  5180m, Spill  5460m, 280m relief, 40 sqkm Area

2 to 7 TCF potential
Q. More than a biogenic gas play to chase in N. Levant Basin?
A. Yes! North Levant is an Oil and Gas Basin.

Q. Levant’s thickest Reservoirs offshore Israel?
A. No! E. Miocene N. Levant 3-5 times thicker.

Q. Are the best structures in South Lebanon?
A. Yes! N Levant has bigger and less complex structure than Offshore Israel
Eastern Mediterranean: Keeps on Giving

Map showing gas fields with labels 50TCF and >100TCF.