The Hydrocarbon Potential of the Deepwater Levantine Basin: An Overview from a Regional Basin Modeling Study of the Eastern Mediterranean

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July 2012

Lebanese International Petroleum Exploration Forum – July 2012

Presentation Outline

- **Introduction**
- **Project Overview: Datasets Used**
- **Project Results**
- **Concluding Remarks**

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Project Objectives

Evaluation of the petroleum systems of the Levantine Basin to delineate potential prospects considering different exploration risk factors such as timing of hydrocarbon generation, expulsion and migration relative to basin tectonic history. Specifically:

•To evaluate the maturation of source rocks and generation/expulsion of hydrocarbons.

•To delineate migration pathways, structural traps, drainage and associated areas.

Scope of Work

Phase I: Data Review and Data Collection

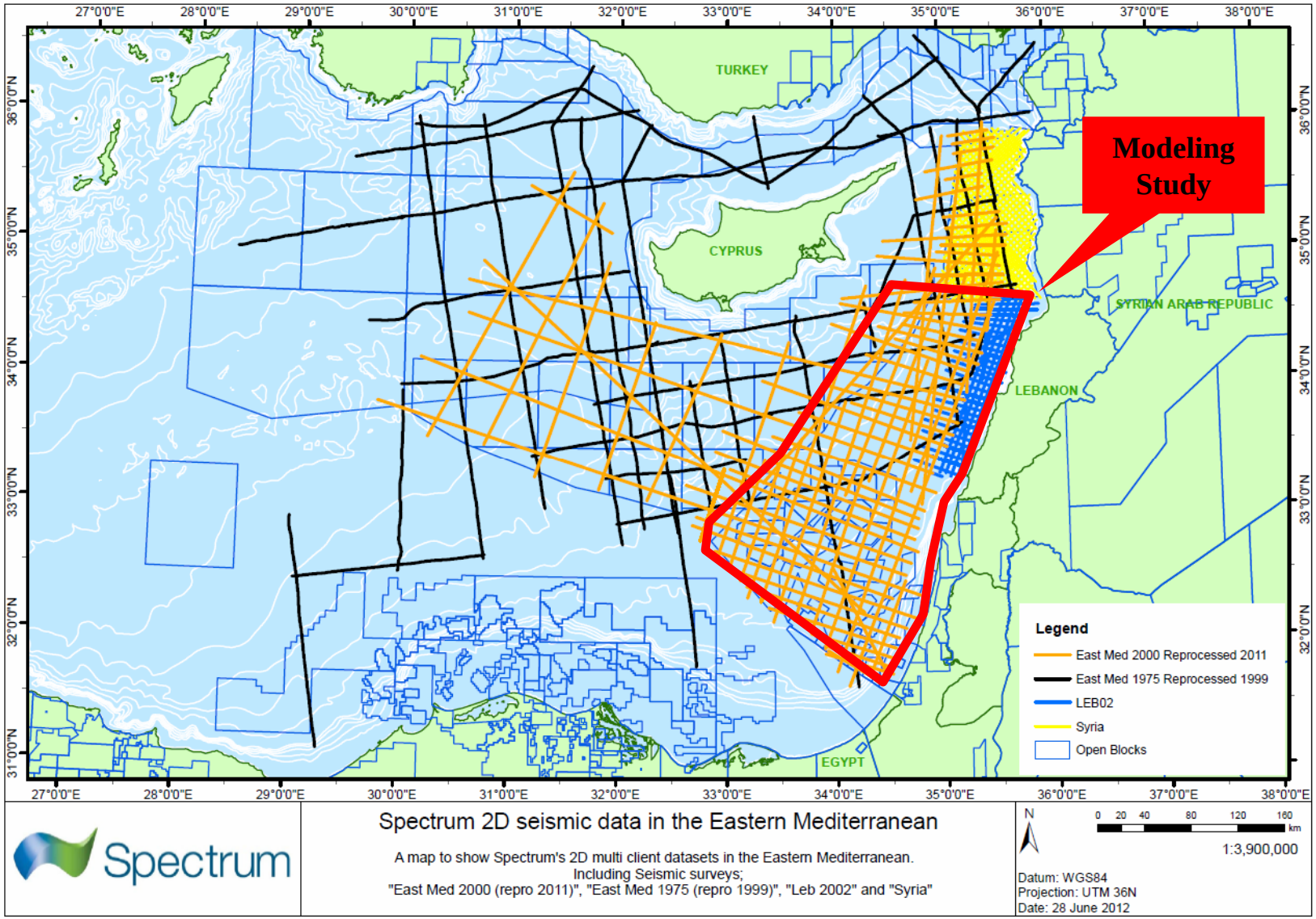
Phase II: Construction of Geological Model:

• Construction of the burial history and estimates of the amounts of erosion during major unconformities.
• Calibration of the burial history against key regional exploration wells.
• Thermal history.

Phase III: Oil & Gas Generation, Expulsion History and Charge BasinView and BasinFlow calculations

• Determination of potential kitchen areas.
• Estimation of the time of hydrocarbon generation and expulsion.
• Delineate migration pathways and potential hydrocarbon accumulations.

Spectrum' Regional East Mediterranean 2D Seismic Database



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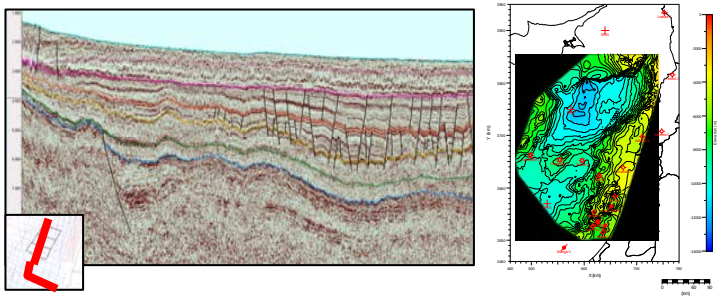
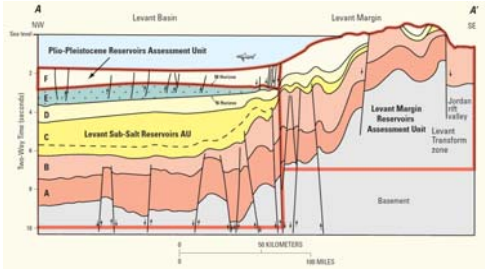
Datasets Utilized in the Study

Spectrum 2D Seismic Data and Interpretation

• Approximately 22,000 line km.



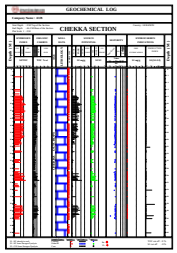
Regional Tectonic Evolution of the Eastern Mediterranean Basin

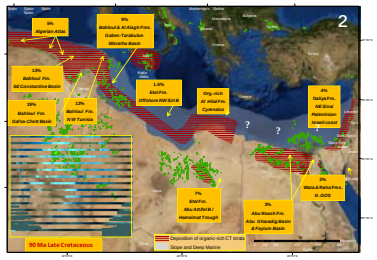


Detailed Geochemical Evaluation and Basin Analysis

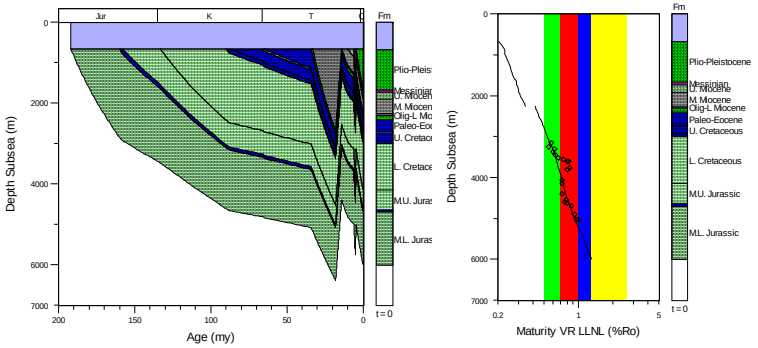
• Lebanon Paleocene-Eocene Chekka Outcrops.

• Oil and gas data from Nile Delta and Shelf in Egypt and SE Levantine Basin.

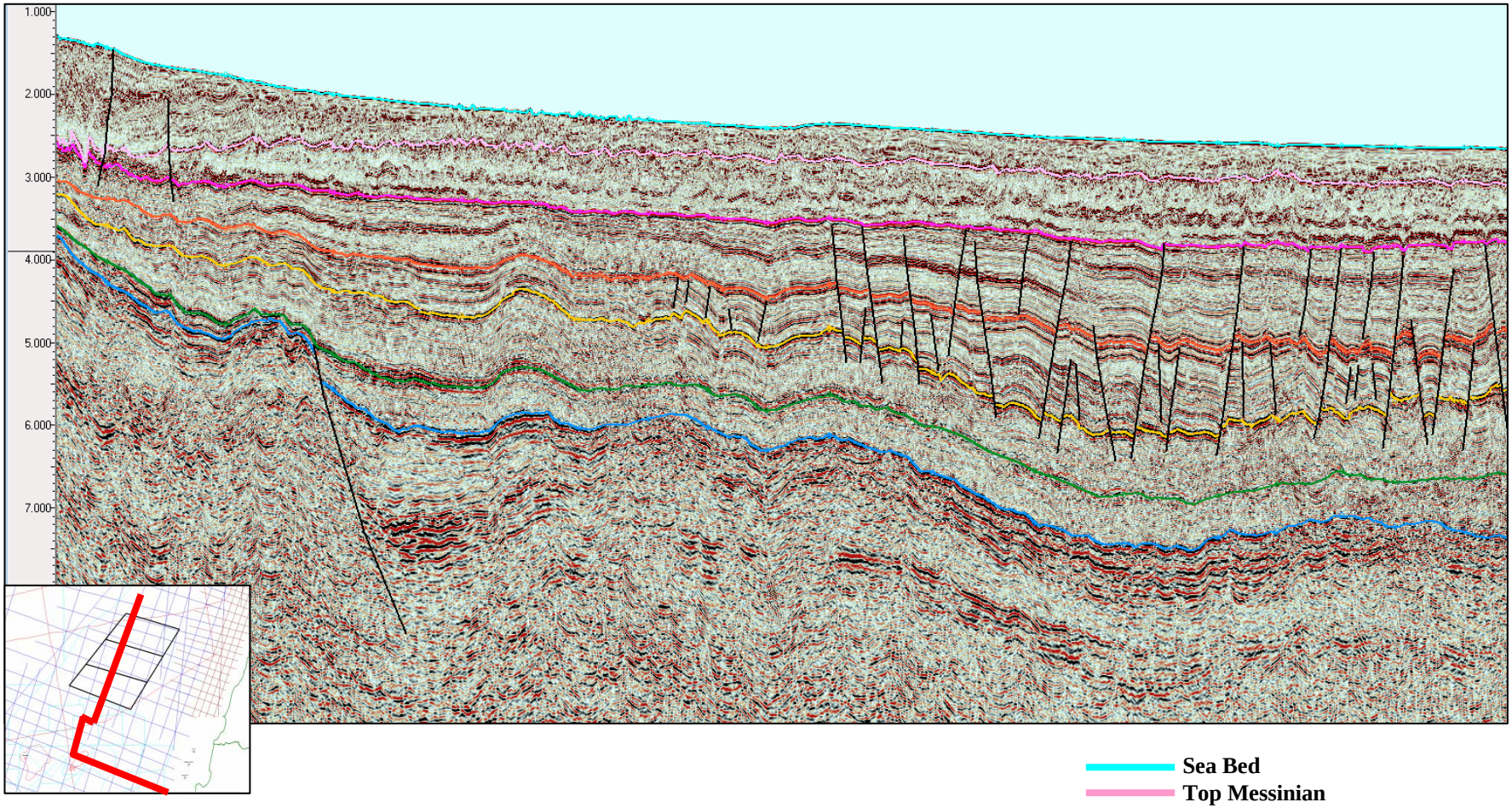




Data from 17 Key Exploratory Wells

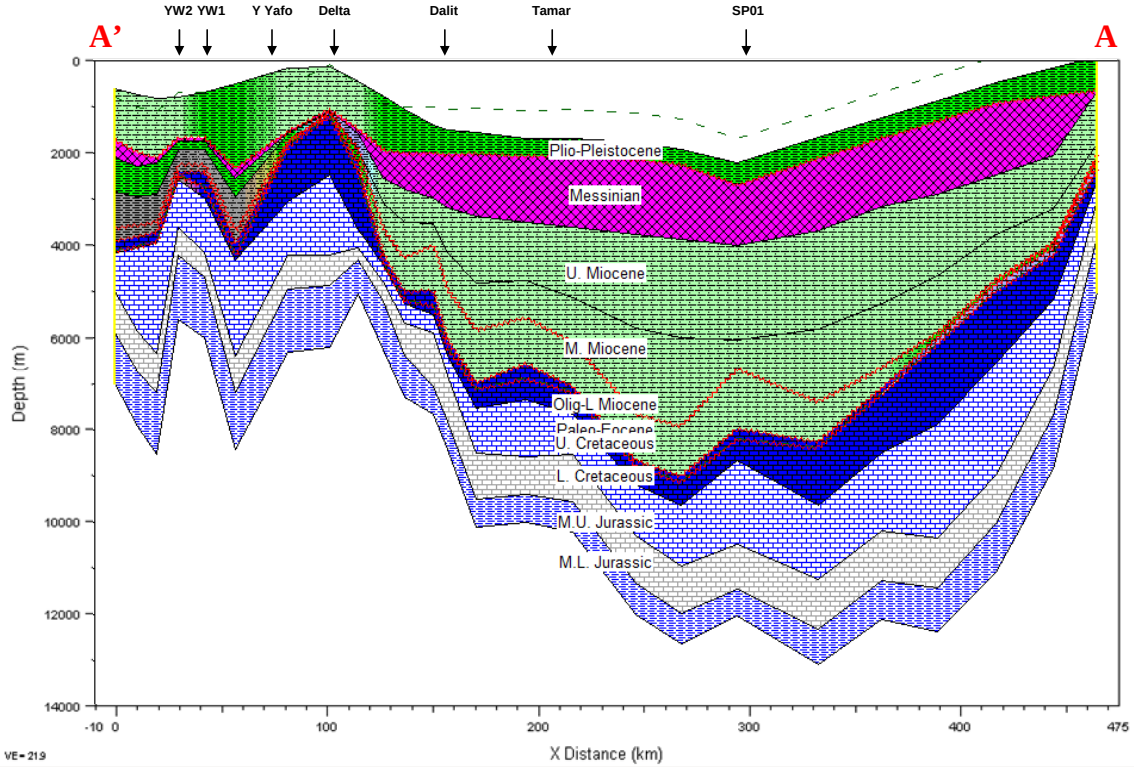


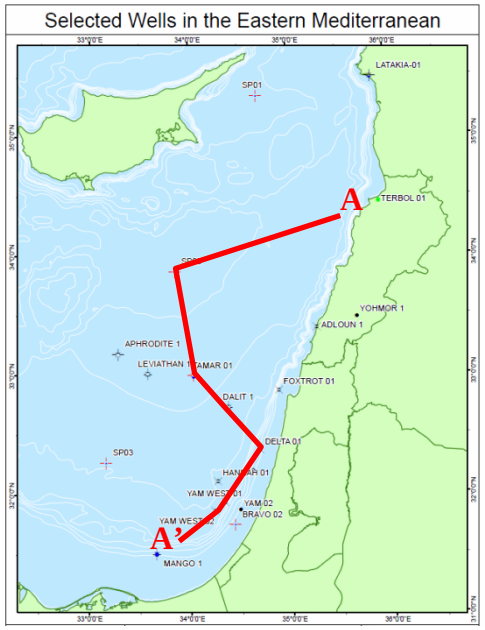
Spectrum 2D Seismic and Interpretation

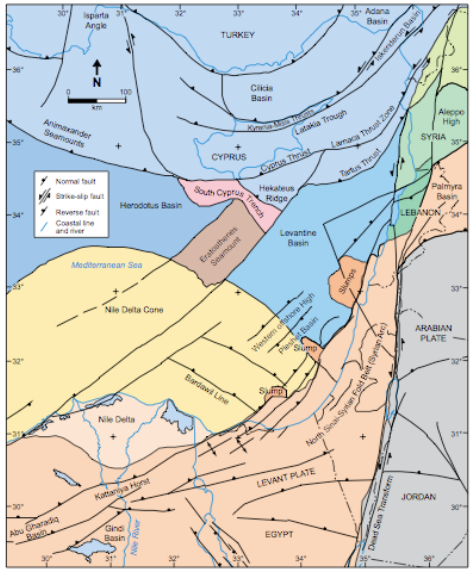


Regional Tectonic Evolution of the Eastern Mediterranean

- **Disintegration of the Pangea supercontinent** in the Permian to Middle Jurassic
- **Formation of a passive continental margin** in the Middle Jurassic to Late Cretaceous
- **Compression in the Late Cretaceous to Paleogene** due to plate convergence
- **Isolation of the Mediterranean sea.**

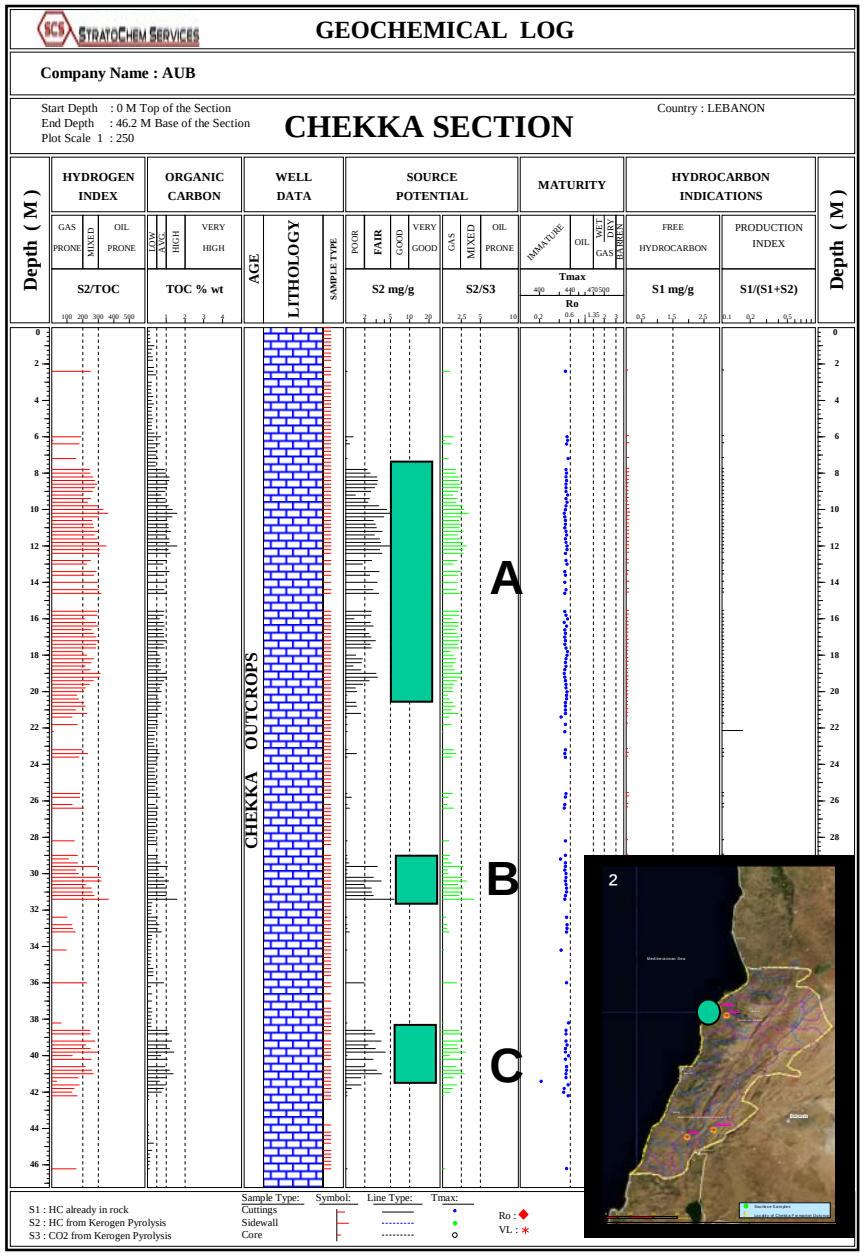






Regional Structural Elements Map

Geochemical Evaluation

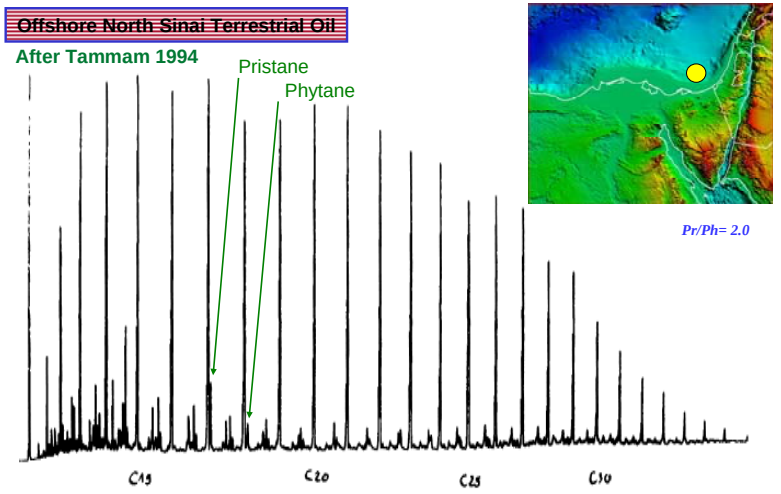


Mainly oil and gas prone source rocks could be distinguished throughout the analyzed 46m outcrop section of the Paleocene-Eocene Chekka Formation, north Lebanon.

Three main source rocks intervals within the section.

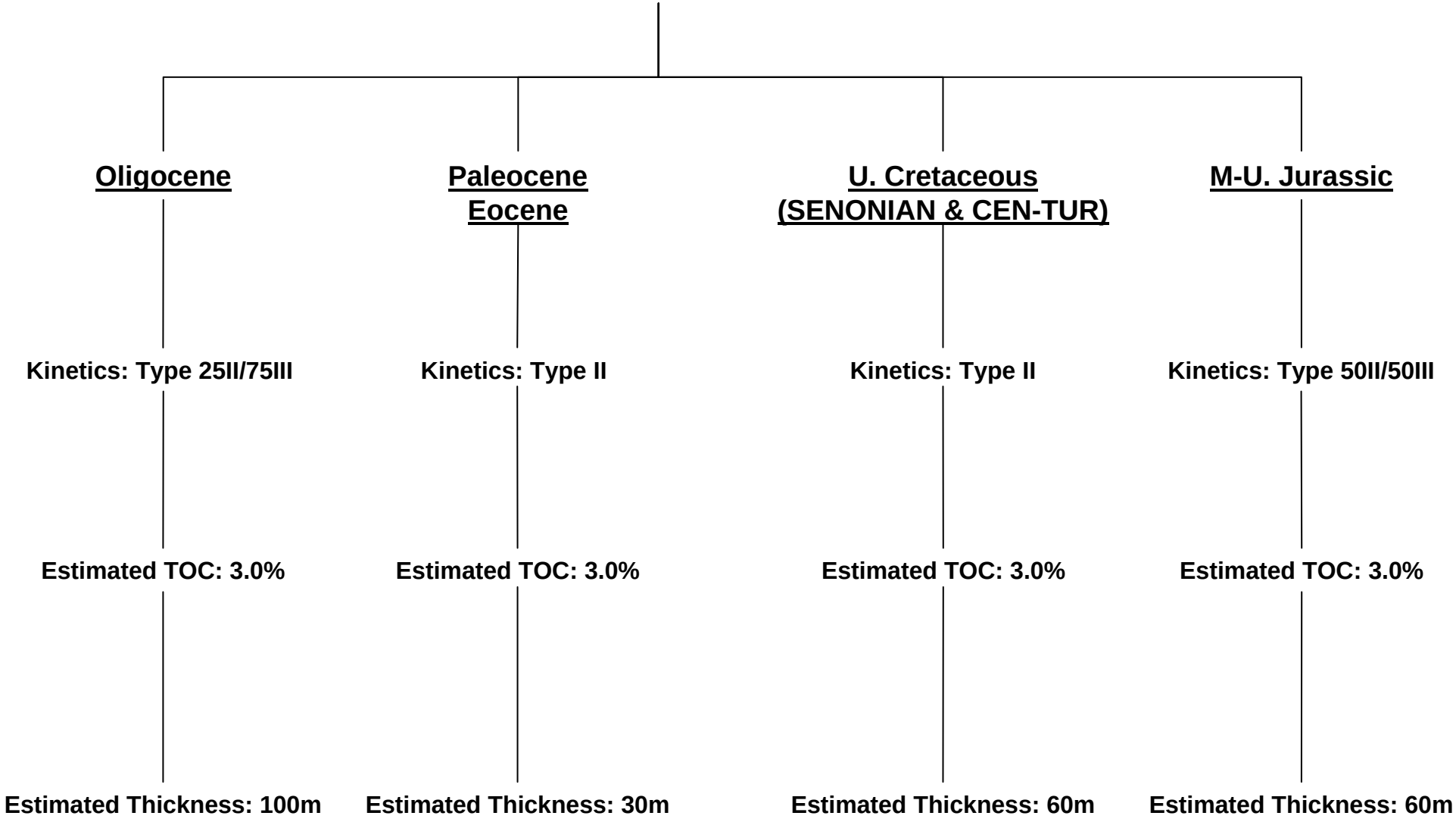
A) 15m in the upper part of the outcrop.
B) 2m in the lower middle part of the outcrop
C) 3m in the lower part of the outcrop

- High TOC content (0.80-1.57 wt. %).
- Fair potential (S2 yield of 1.95-5.75 mgHC/gRock).
- Oil and gas prone (HI values of 220-366 mgHC/gTOC).
- Marginally mature (Tmax values ~430-435˚C).

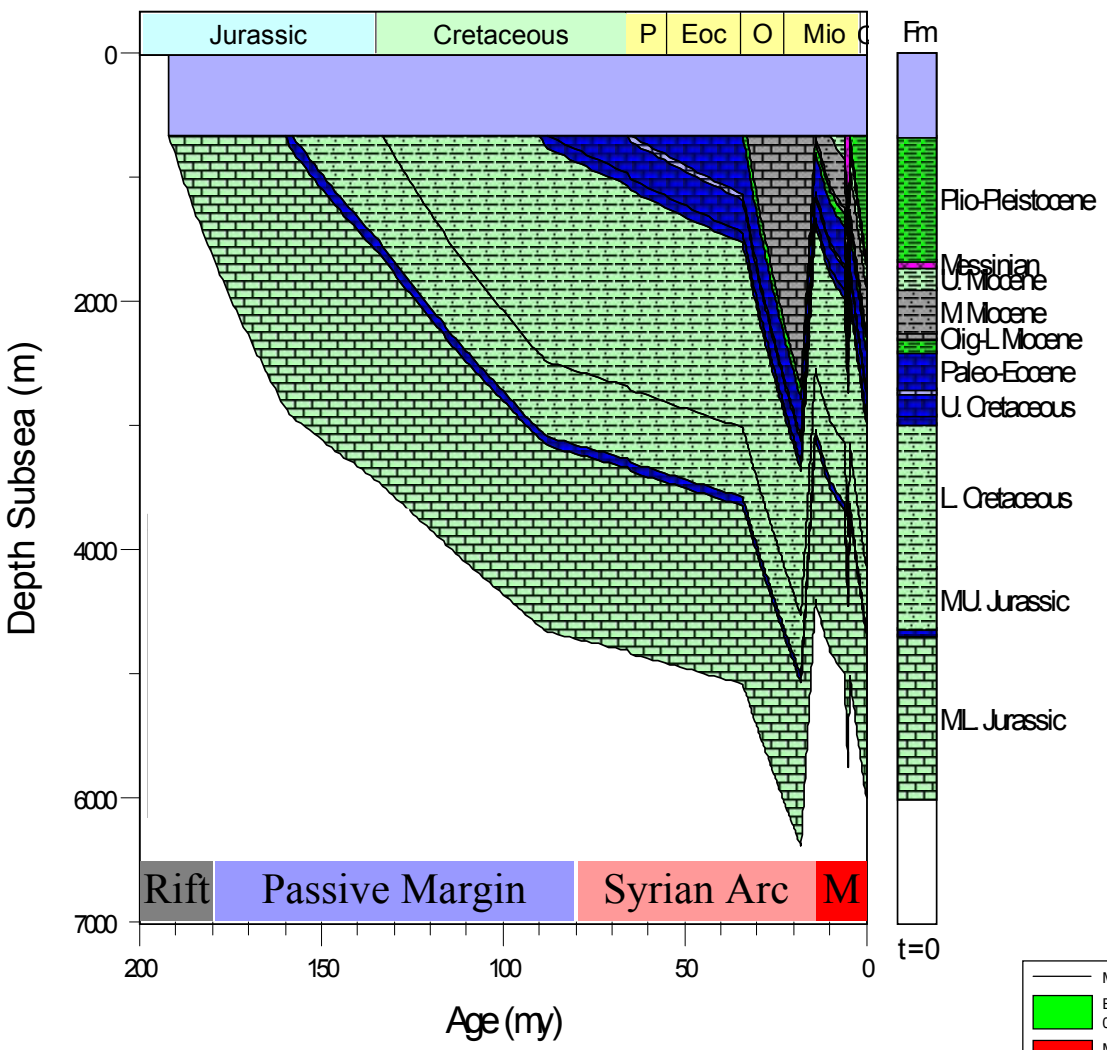


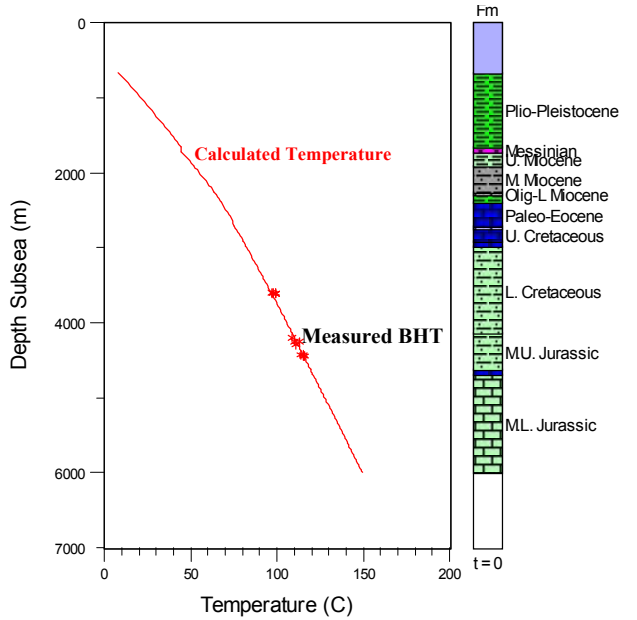
Whole oil gas chromatogram for marine sourced oil recovered from Offshore North Sinai

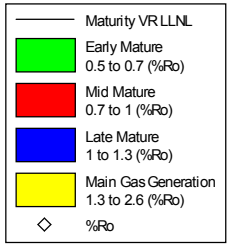
East Mediterranean Regional Source Rock Assessment

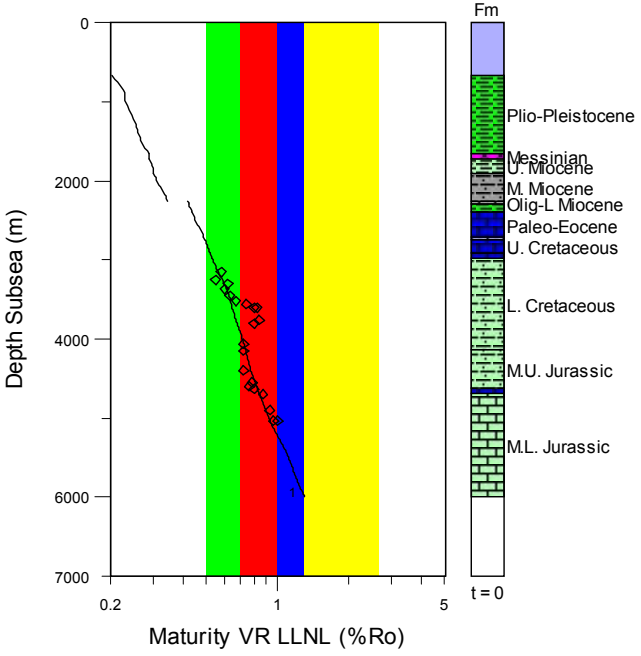


Key Exploration Wells: Yam W-1 Basin Modeling









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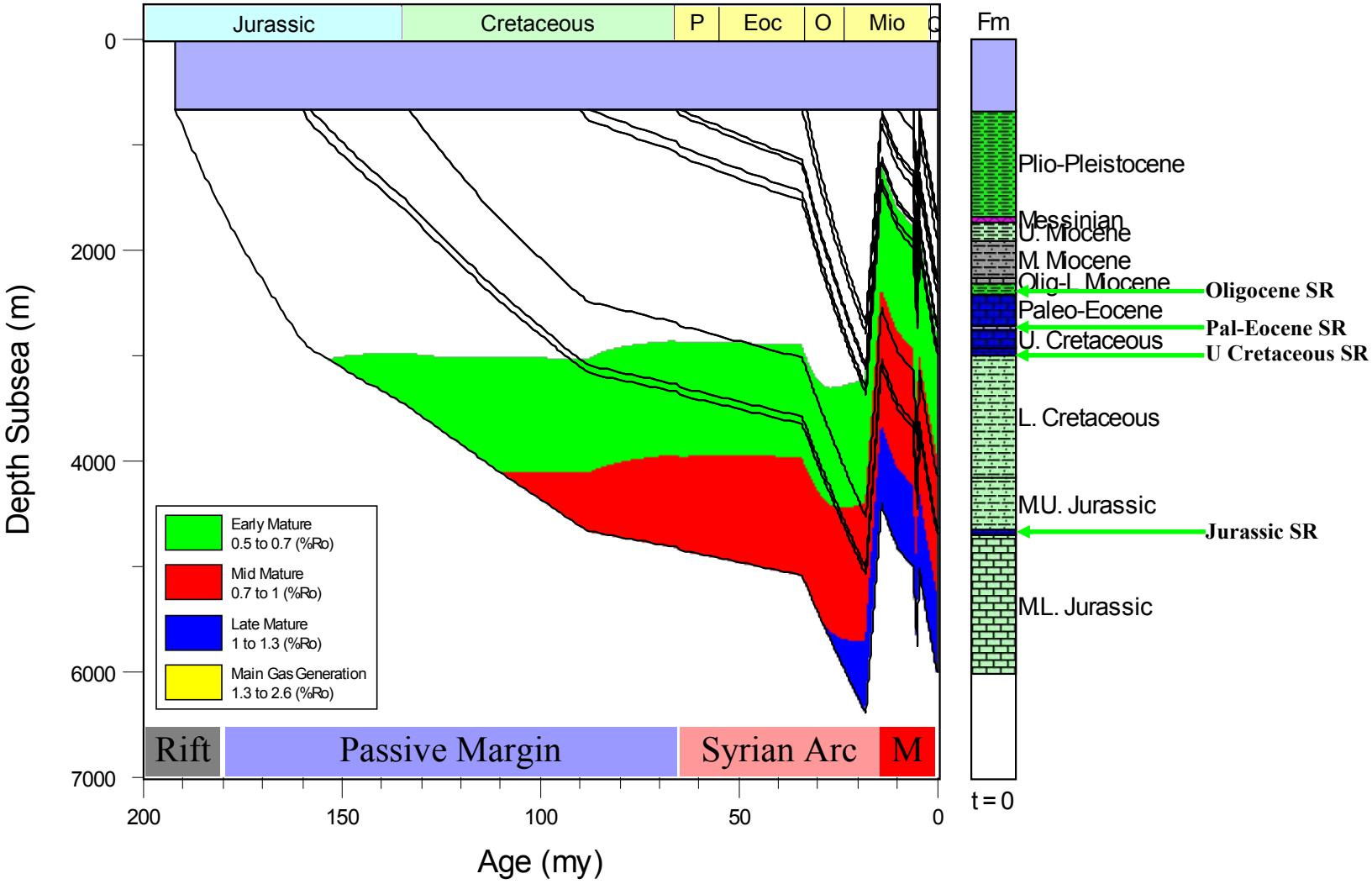
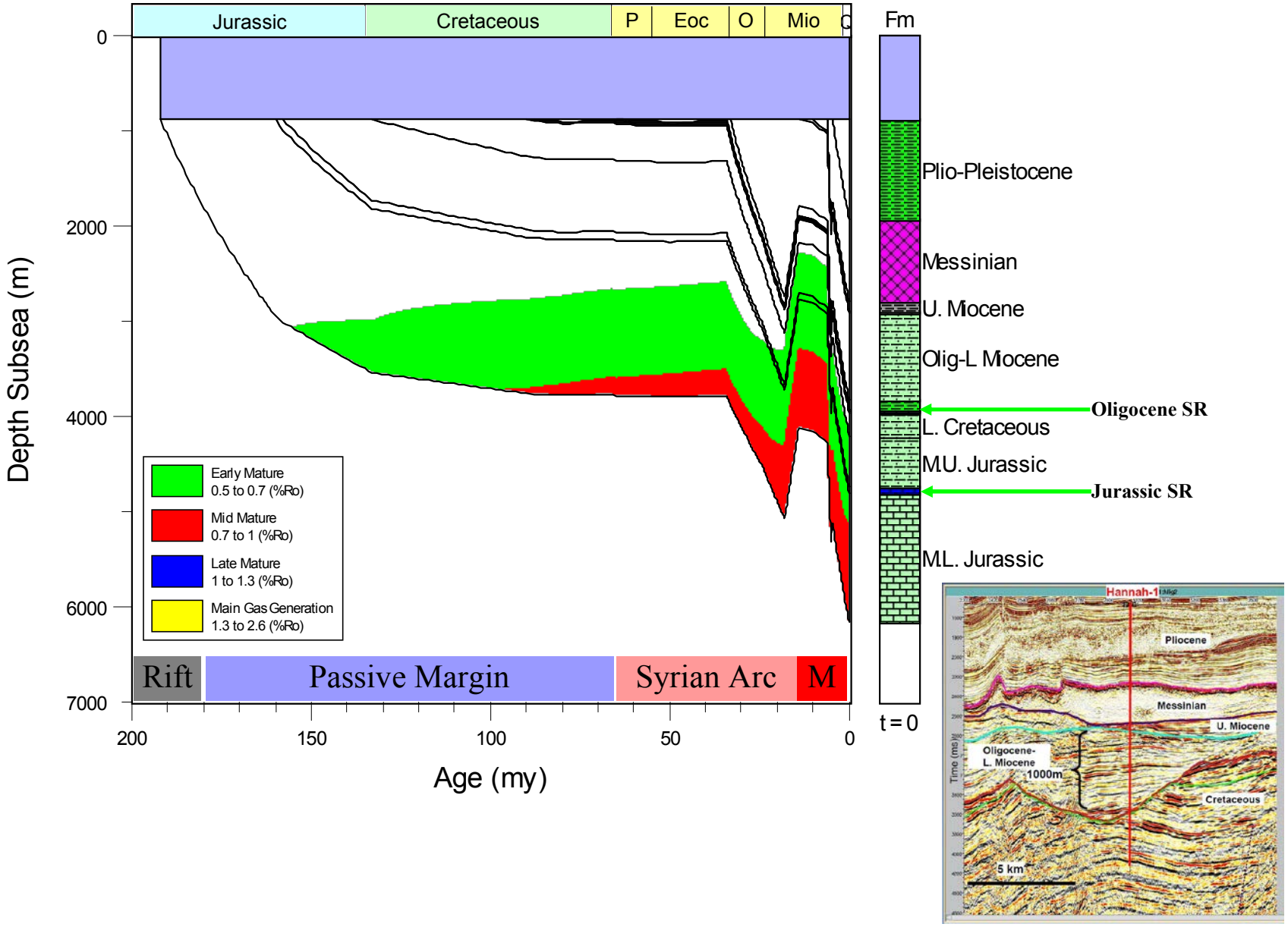


Key Exploration Wells: Hannah 1 Well Basin Modeling



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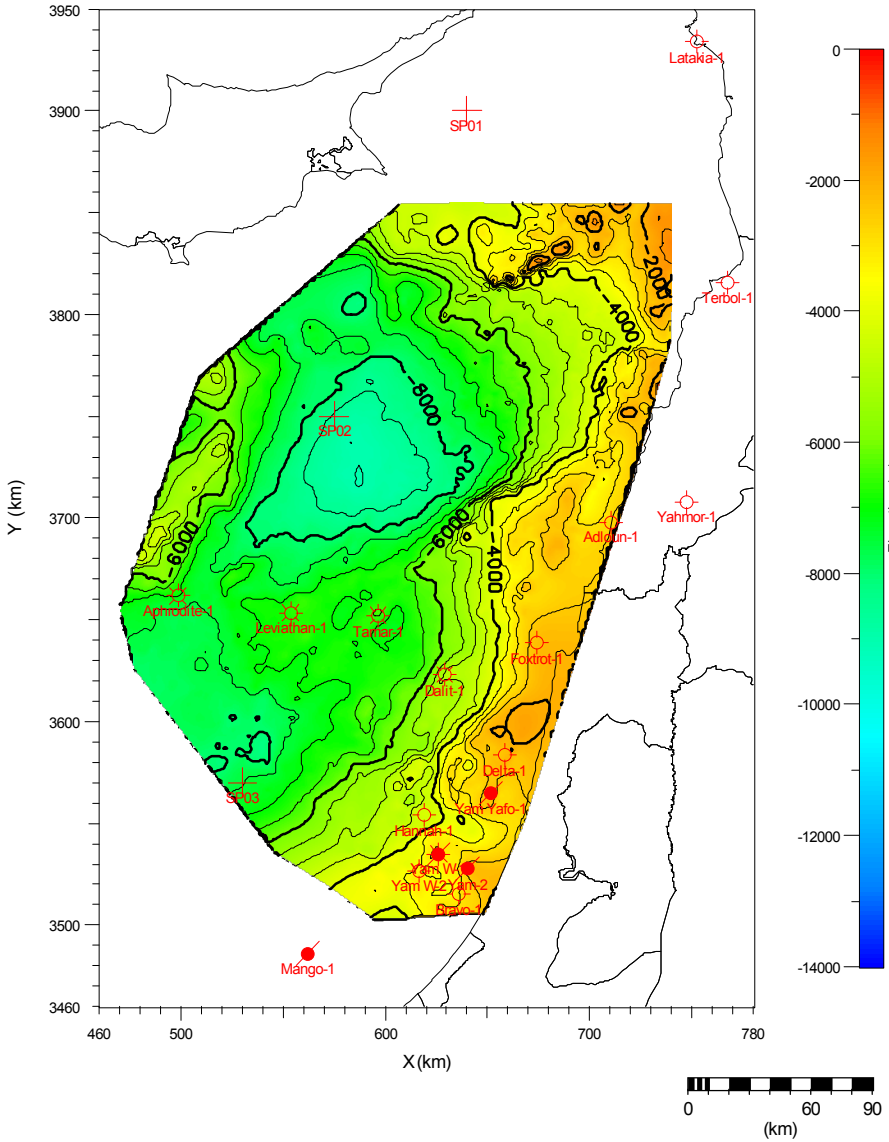
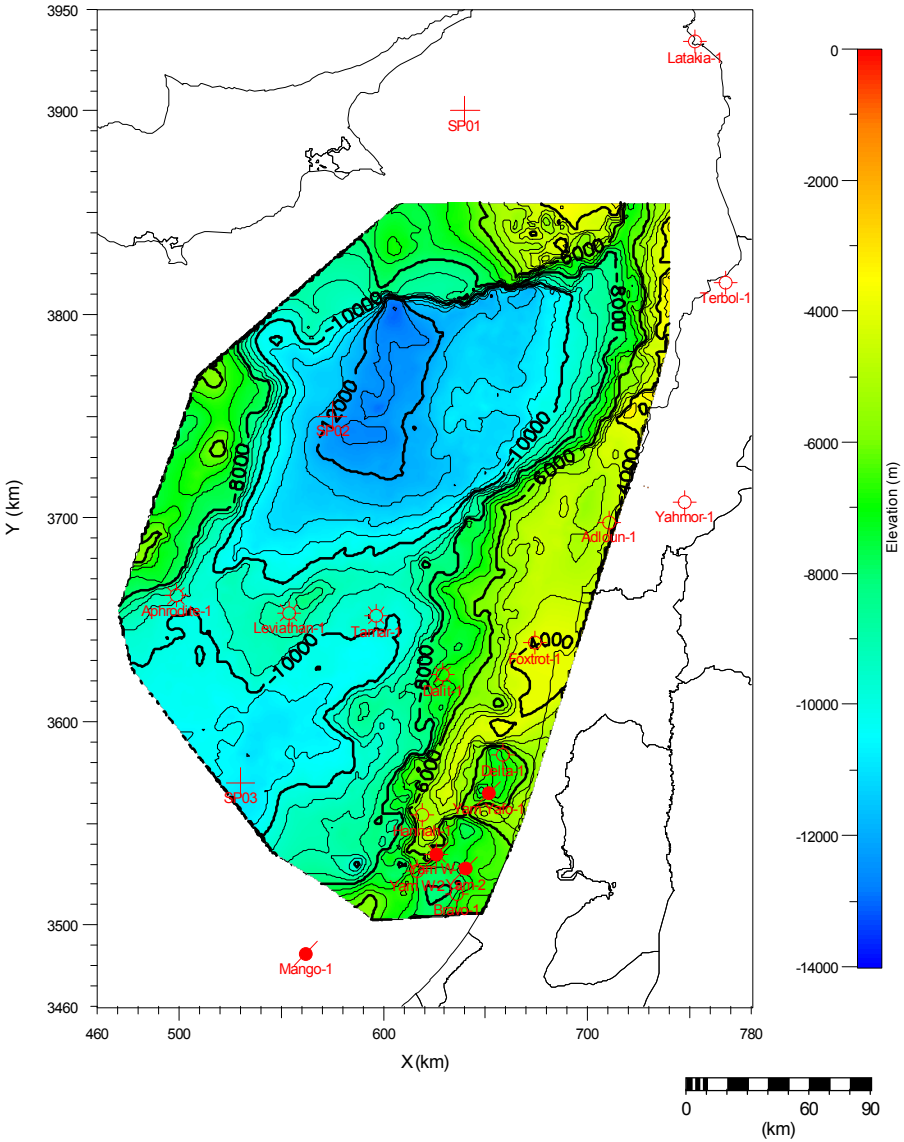
Seismic Depth Maps

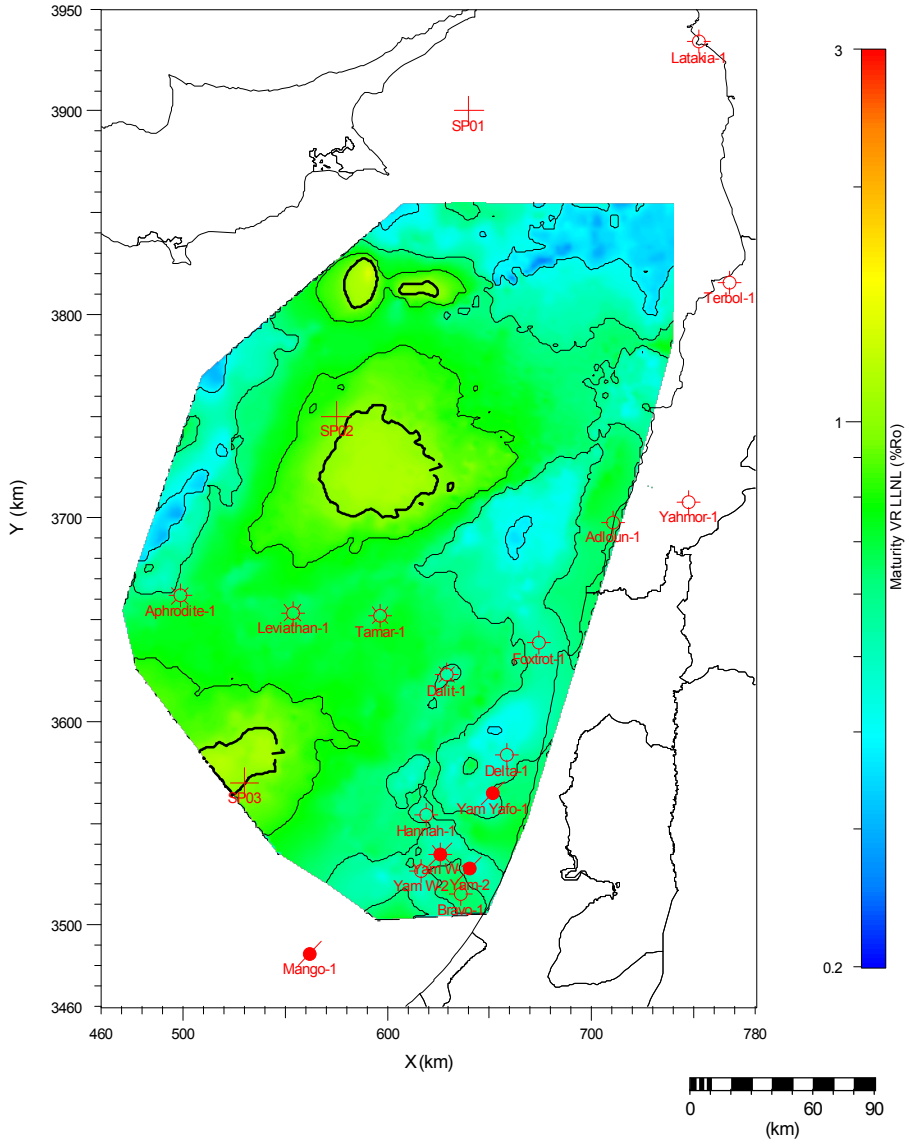


Oligocene SR (Source Rock)

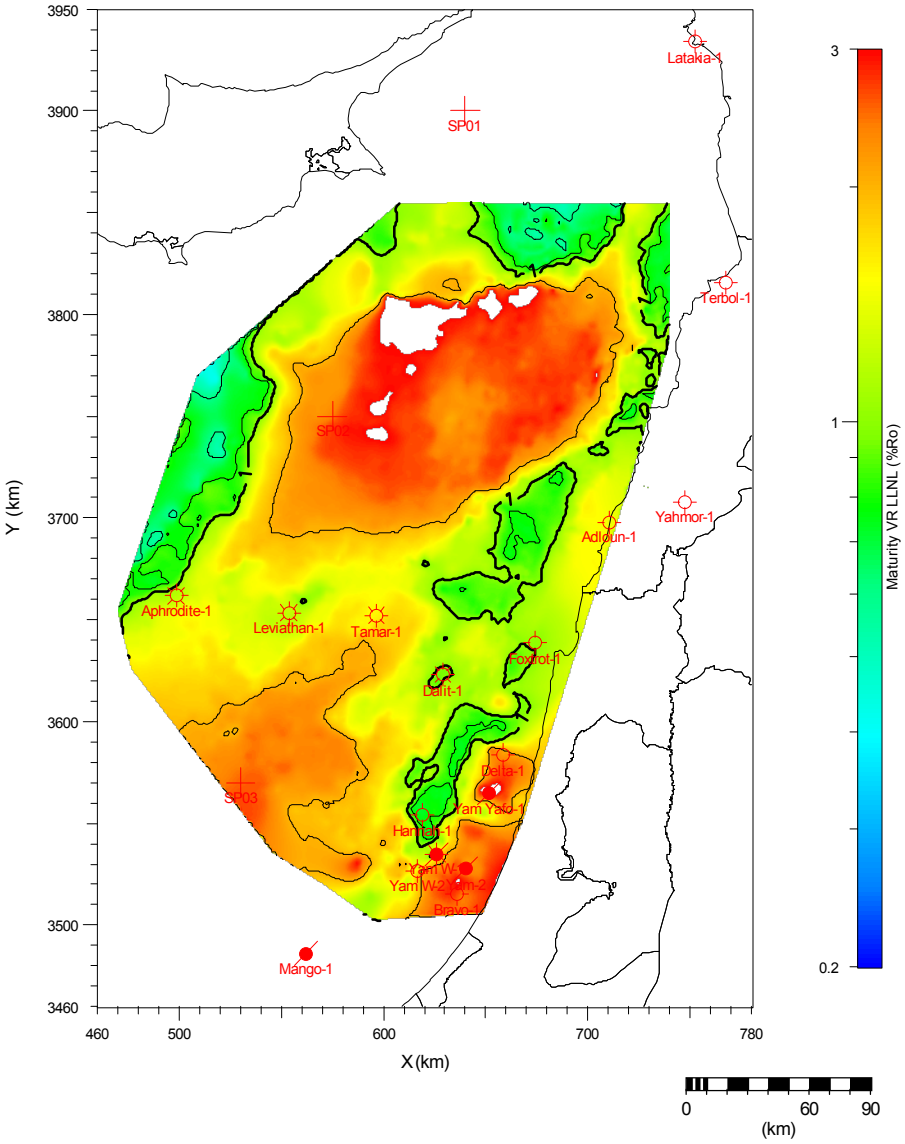


Jurassic SR (Source rock)

Maturity of the Oligocene and Jurassic Source Rocks

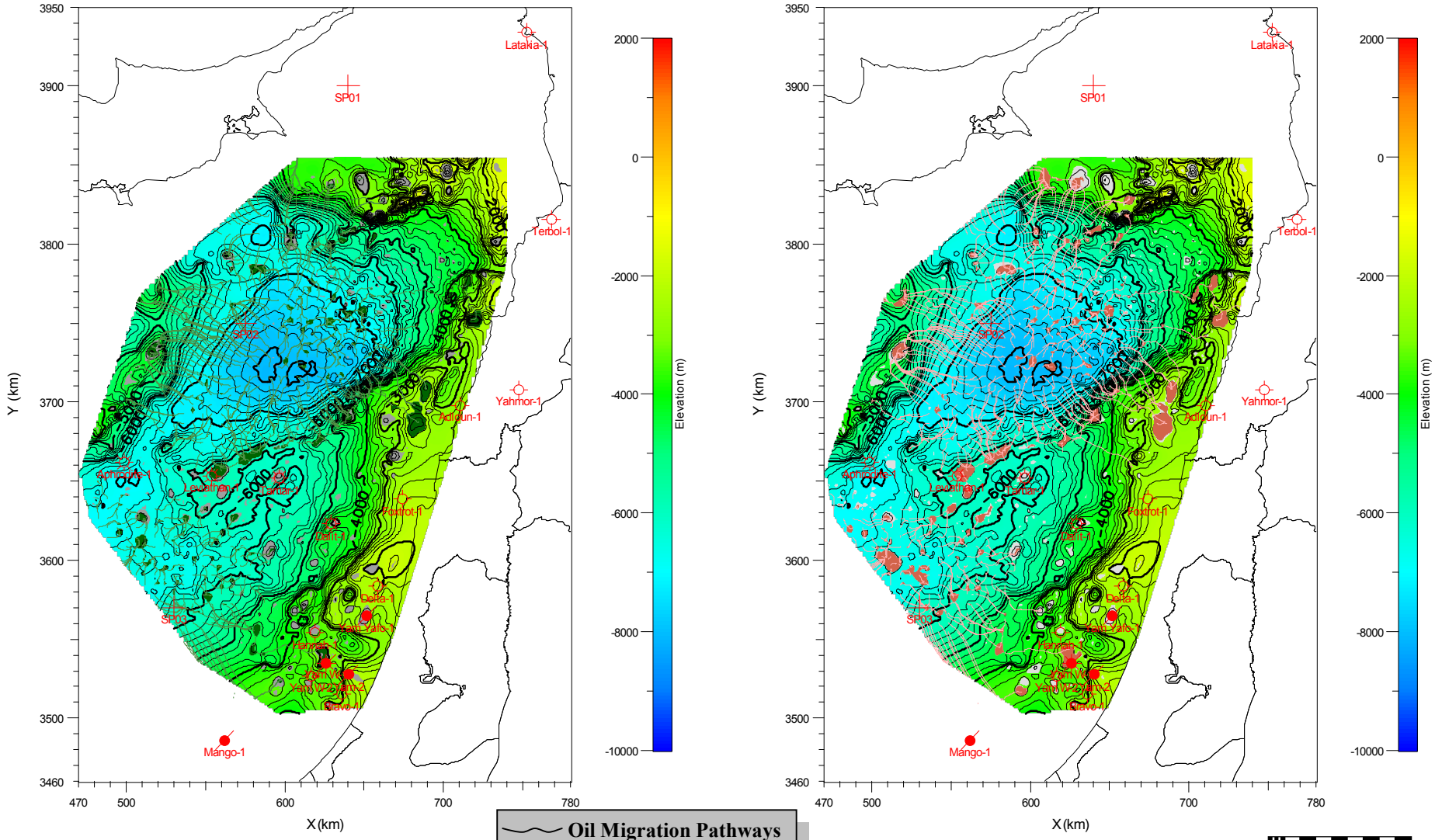


Oligocene SR



Jurassic SR

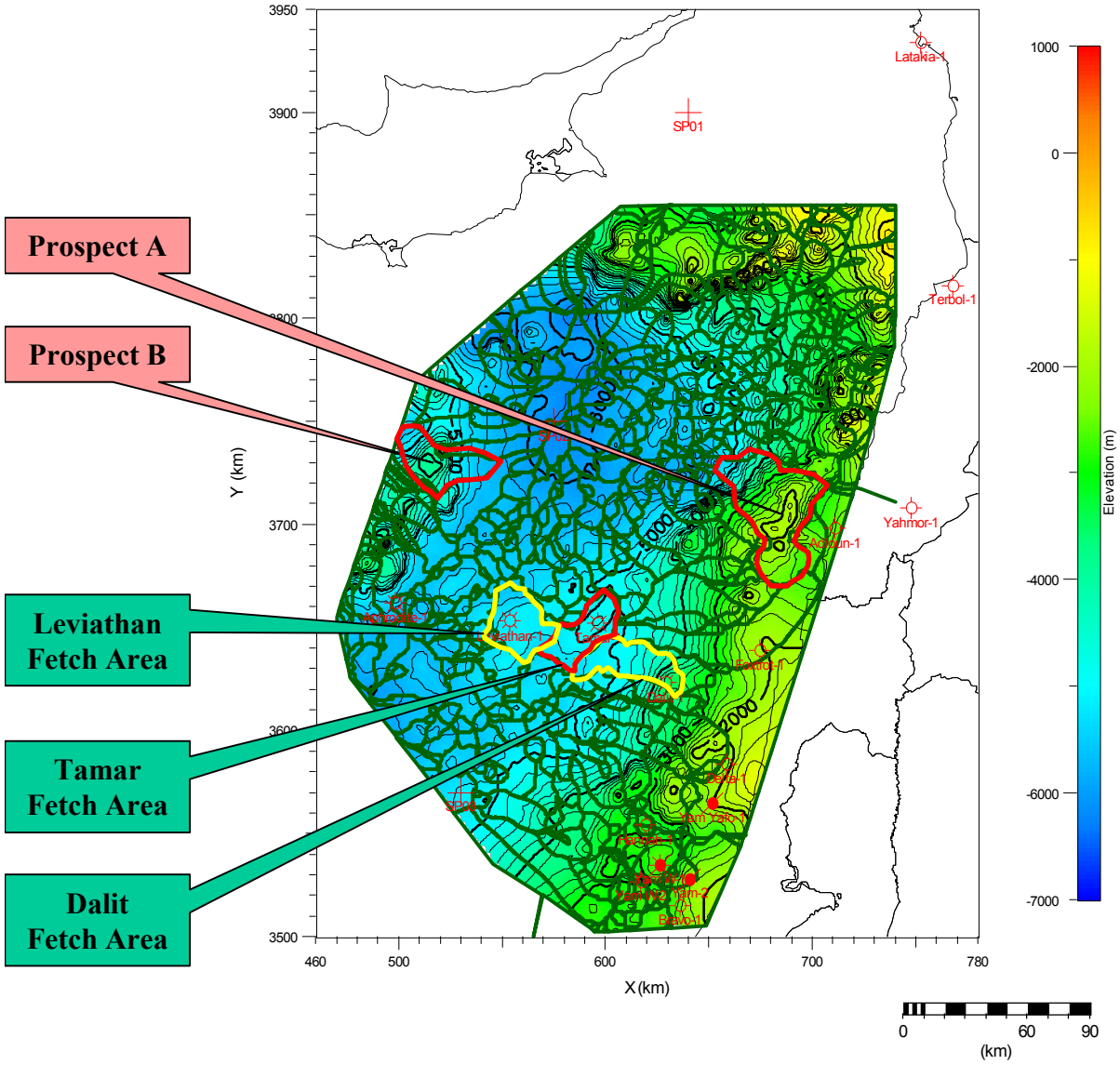
Hydrocarbon Charge for Potential Lower Miocene Reservoirs from Oligocene Source Rocks



Oil Charge

Gas Charge

Biogenic Gas Assessment of the Lower Miocene Reservoirs



- Tamar Fetch Area 650 km^2
- Leviathan Fetch Area 750 km^2
- Dalit Fetch Area 750 km^2

For each prospect we calculated the area that could charge such prospect (Fetch Area) and with analog to Tamar, the amount of biogenic gas that could charge the prospect, can be calculated.

The trapped amount will mainly depend on the reservoir parameters (thickness, area, etc.)

- Prospect A Fetch Area 1750 km^2
  Estimate ~16 TCF
- Prospect B Fetch Area 750 km^2
  Estimate ~8 TCF

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Concluding Remarks

- Proven biogenic gas source rocks extend to the Eastern Mediterranean including offshore Lebanon.
- Further prospectivity now identified and associated with other, deeper potential source rocks.
- The Relatively lower geothermal gradient promote the existence of oil in deeper sequences.
- Mesozoic source rocks are fully transformed to HC within the deepest basinal areas, whereas of lower maturity towards the basin margins.
- The younger Tertiary source rocks show a lower maturity relative to the Mesozoic source rocks and at present below the condensate window in the deepest basinal areas.
- The model suggests several oil and gas accumulations are waiting to be discovered.
- Once the study was carried out on a regional scale basis, the uncovered prospects should be studied in further detail.