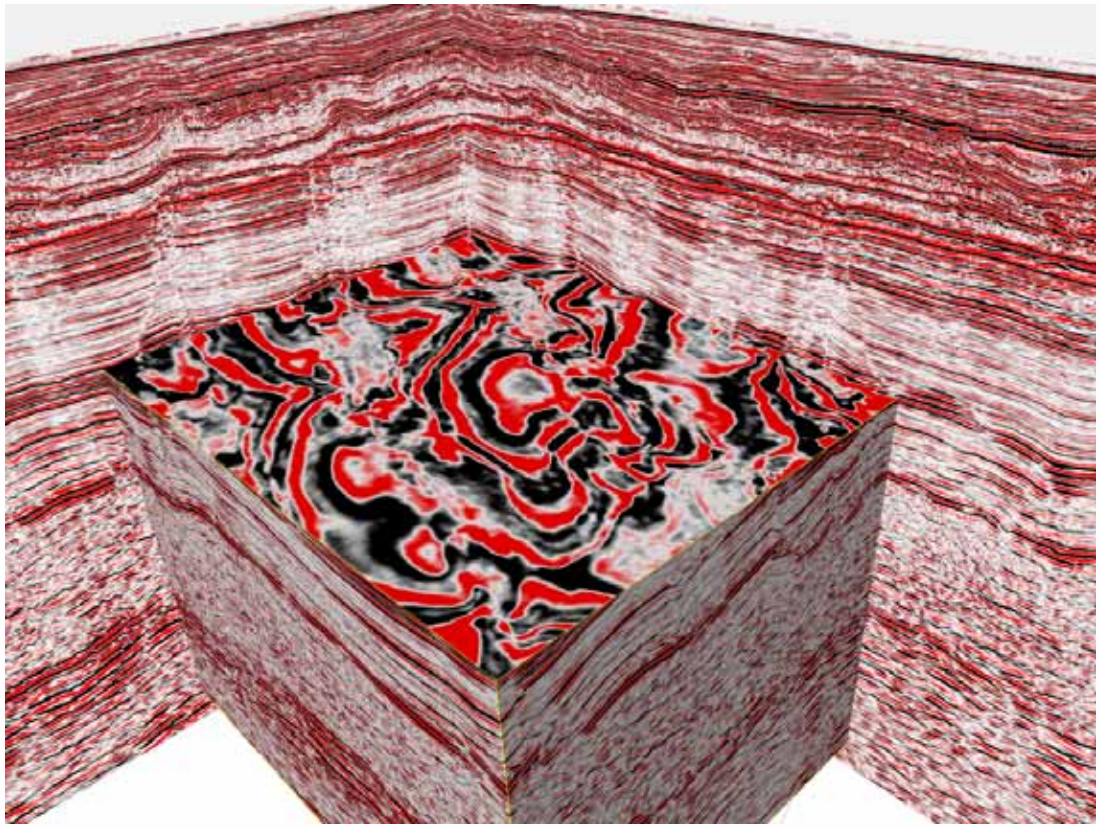
Finding Petroleum
Oil & Gas Technology

Spectrum

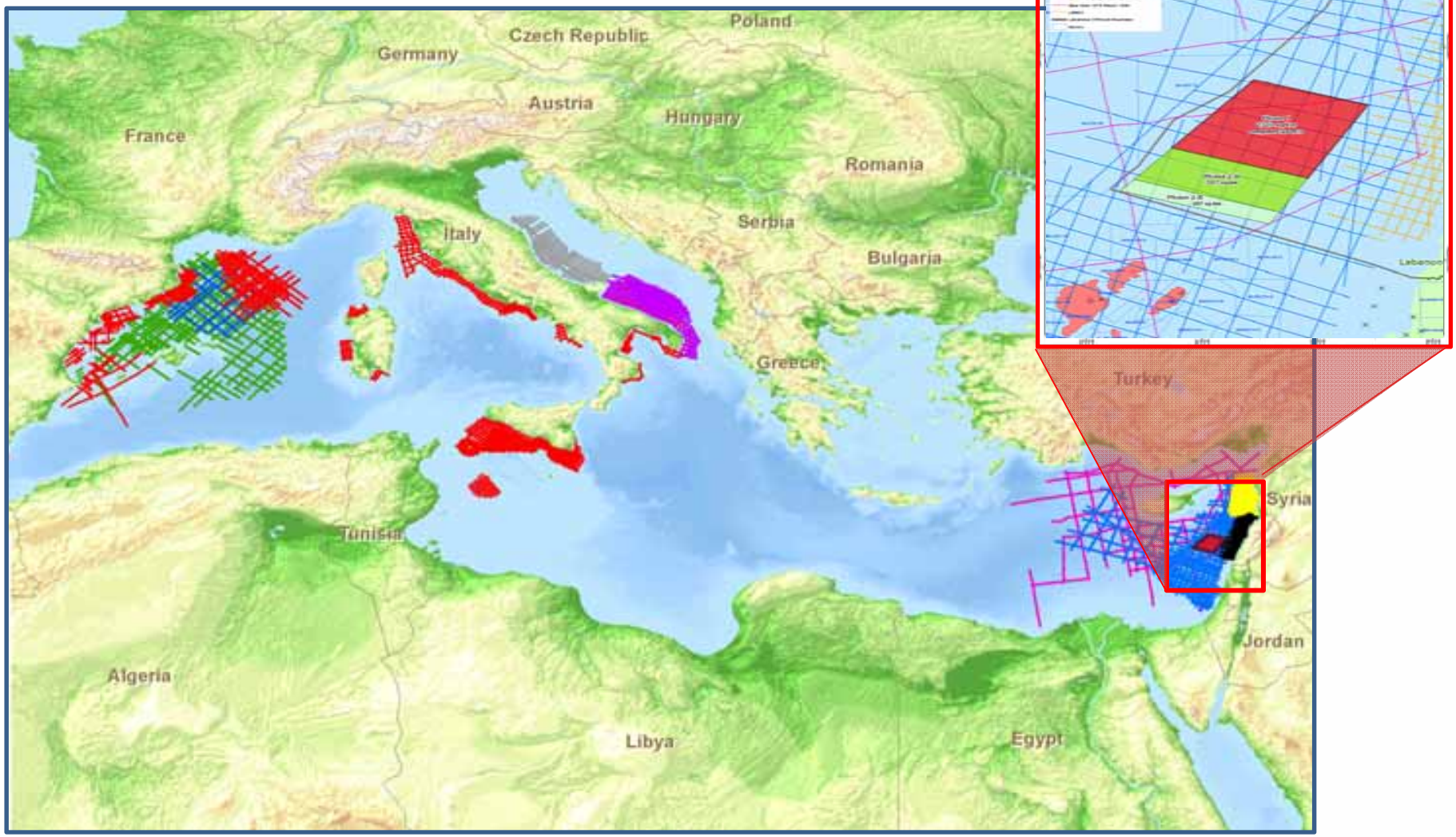
The Hydrocarbon case For Lebanon



Neil Hodgson

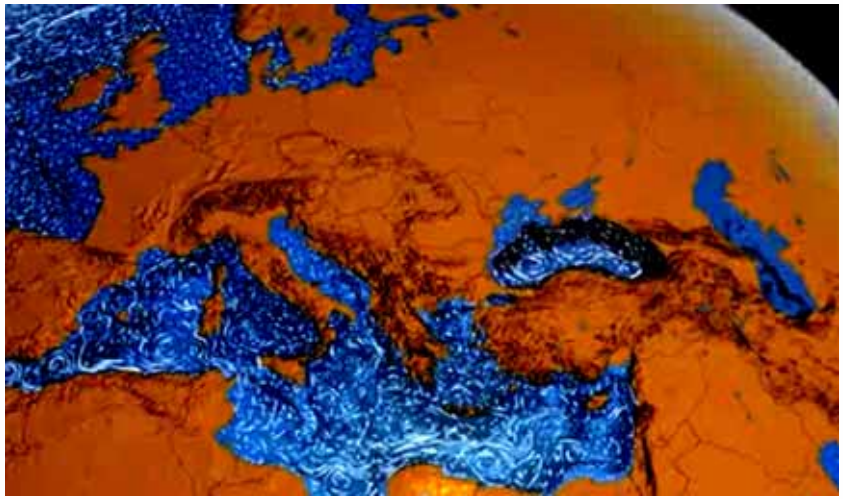
Feb 2013

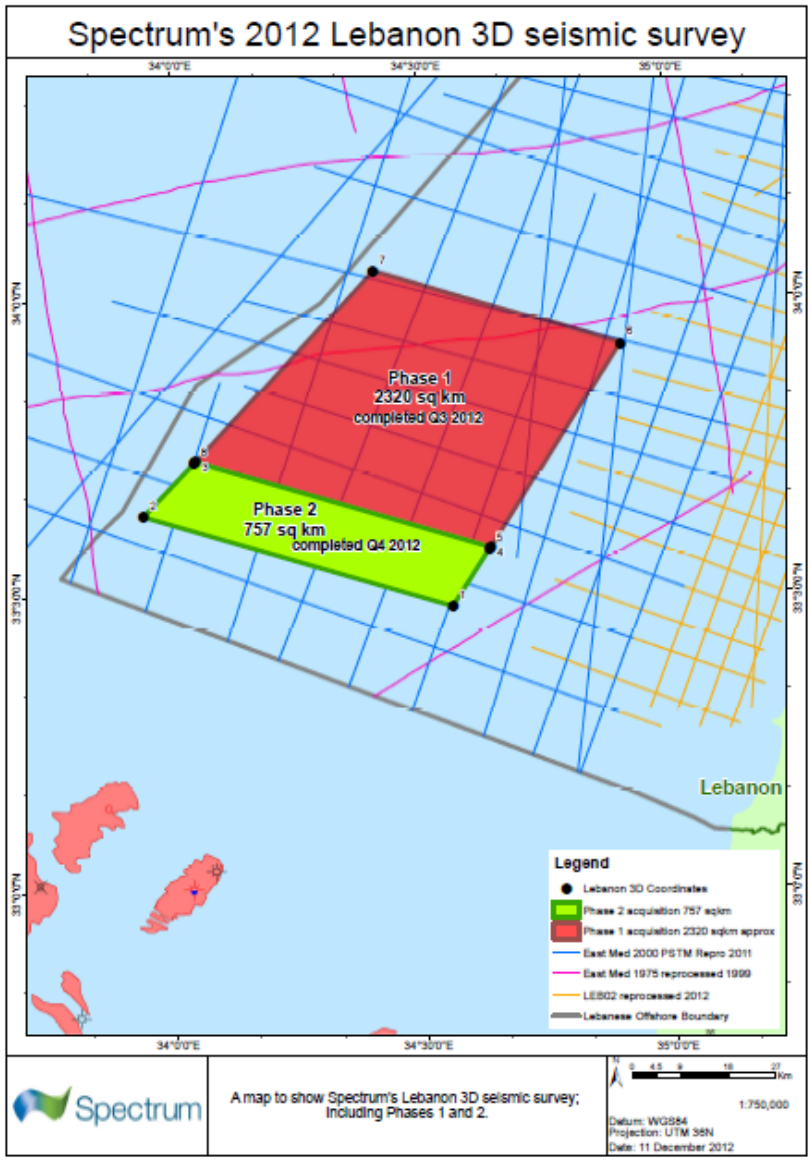
Spectrum's 2D and 3D Multi-Client Mediterranean dataset



Lebanon 3D

- Phase 1: (2320 sq km) full fold data
- Acquisition in 1 month, 77sq km/day
- Acquired by Dolphin's Polar Duke
- Perfect weather conditions
- Excellent Data quality
- Phase 2: (757 sq km)
- Acquisition by Fugro's Geo Barents.





Lebanon Petroleum Administration

- Petroleum Administration elected by Council of Ministers – Walid Nasr, Naser Htayet, Wissan Chbat, Gaby Daaboul, Wissam Zahabi and Assem Abu Ibrahim

Council Of Ministers

Minister of Energy and Water

Petroleum Administration

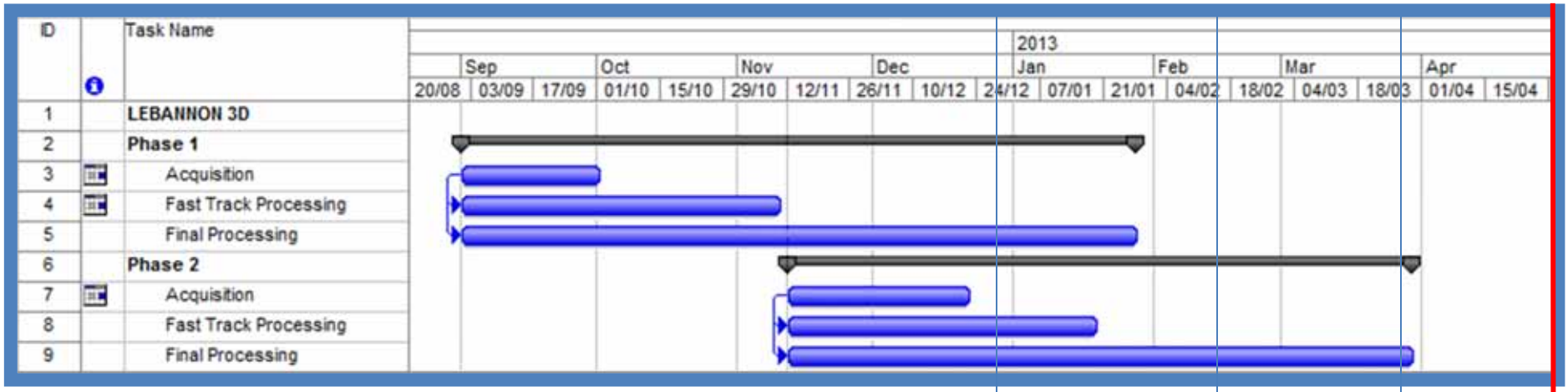
President of PA (rotation)

- Administrative and Personnel division
- Financial Division
- Internal Auditing

N.B : Board members are department heads Elected on 7th November

- Strategic Planning Dpt.
- Technical & Engineering Dpt.
- Geology and Geophysics Dpt.
- Legal Dpt.
- Economics & Financial Dpt.
- Quality , Health , Safety & Environment Dpt.

Timeframe Seismic & License Round Phases 1&2.



Bid Round Announced 27 Dec 2012

Pre Qualification submission Feb 2013

Short-List Published 26th March

Bid Round Opens 2nd May

1st Licensing Round

PRE-QUALIFICATION CRITERIA

Companies may pre- qualify as an Operator or Non-Operator. Pre-Qualification criteria address the following main categories:

1. **LEGAL**

   Joint stock company conducting Petroleum Activities as defined in Offshore Petroleum Resources Law

2. **FINANCIAL**

   Right-holder Operator: Total assets of USD 10 Billion **Right-holder Non-Operator:** Total assets of USD 500 Million

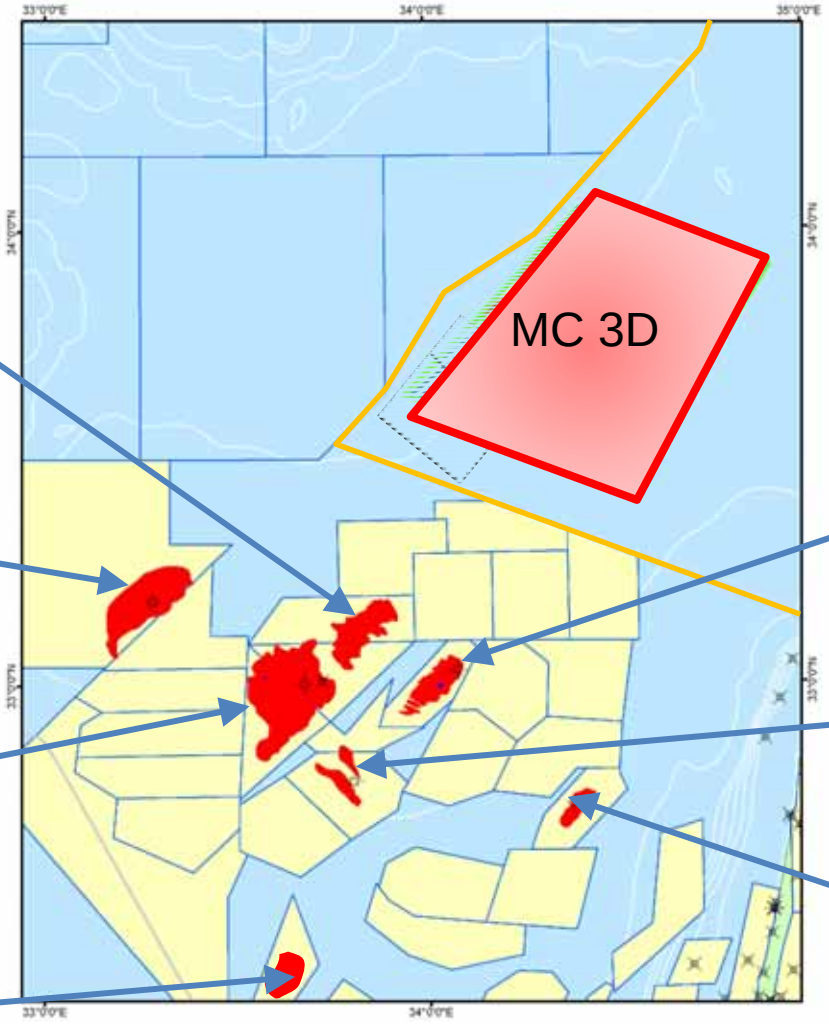
3. **Technical**

   Right-holder Operator: Operatorship of at least one petroleum development in water depths in excess of 500m
   Right-holder Non-Operator: Having an established petroleum production

4. **QHSE**

   Evidence of established and implemented QHSE Management Systems

South Levantine Basin: What's the fuss about?



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

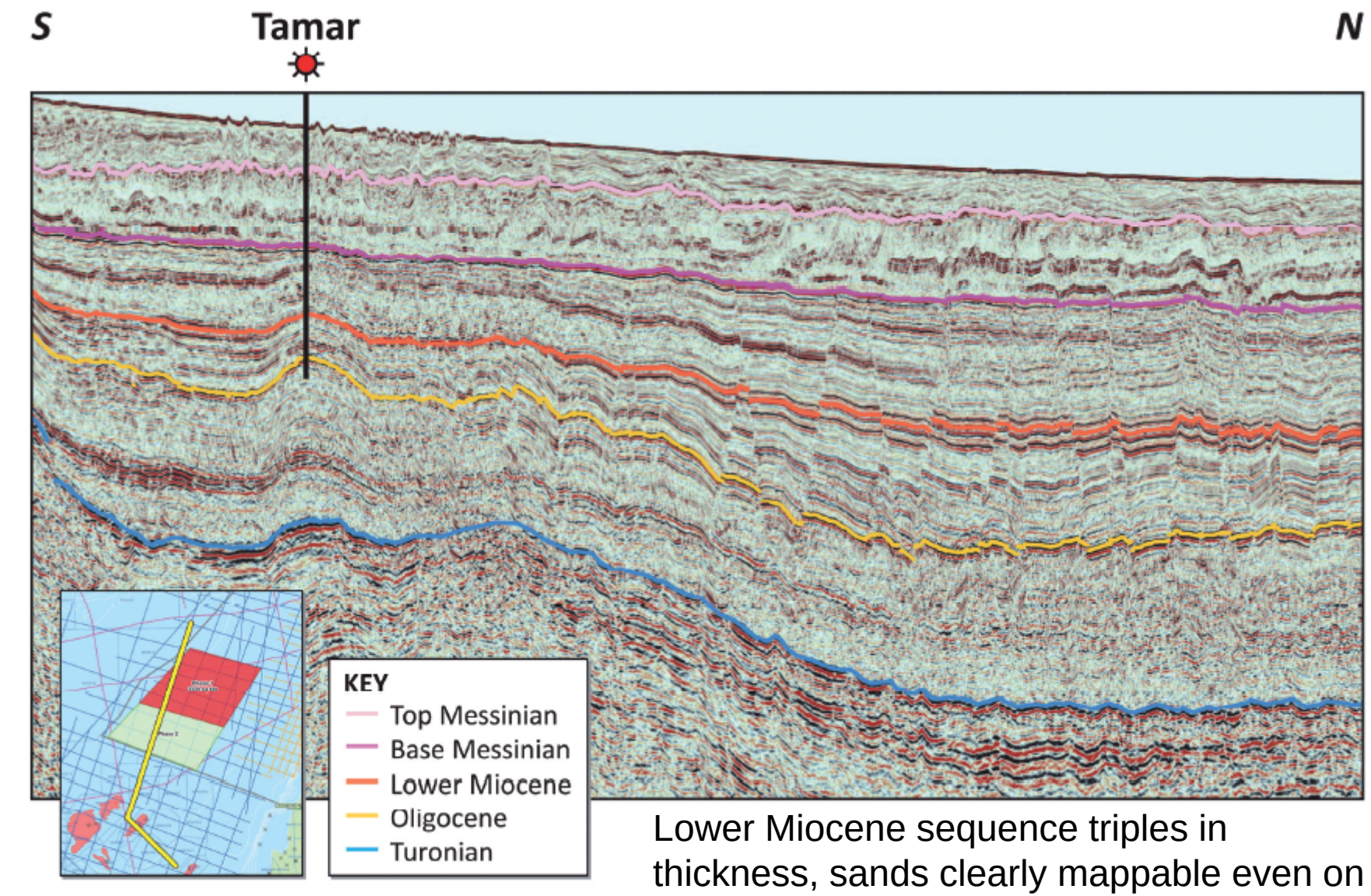
Shimsom
2012 Gas Discovery
Reserves: Mean 4 TCF.

Tamar
2009 Gas Discovery
460ft net Mid- Lower Miocene sands
Reserves Mean 8 TCF

Dolphin
2011 Gas discovery
'Tamar' sands
Reserves: Mean ca 0.5 TCF

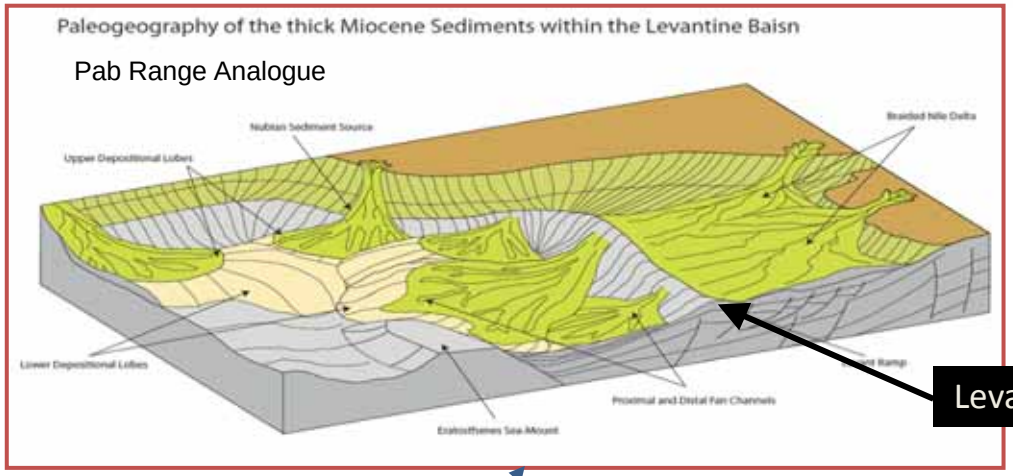
Dalit
2009 Gas Discovery
Lower Miocene Sands
Reserves: Mean 0.5 TCF

Extrapolating from southern Levant, northwards into south Lebanon

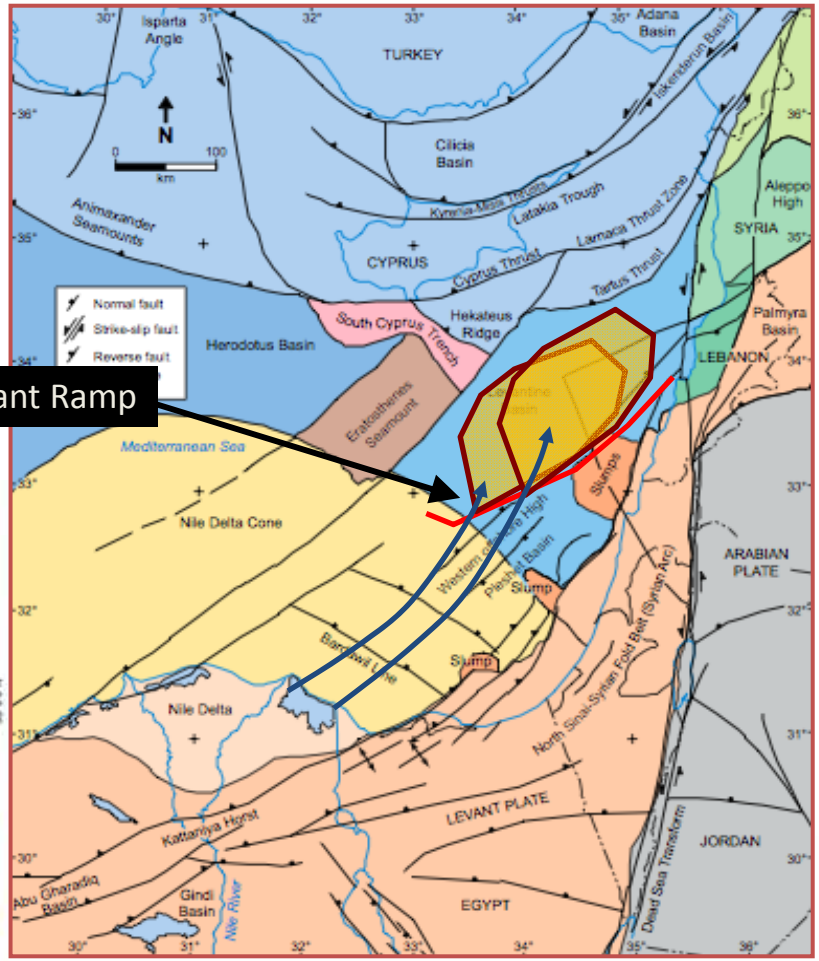


Lower Miocene sequence triples in thickness, sands clearly mappable even on 2D seismic…

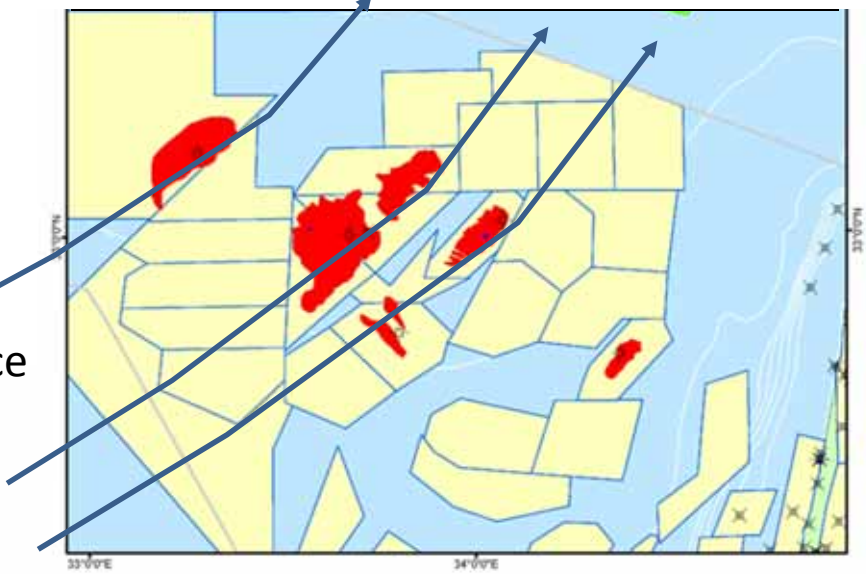
Sand Provenance



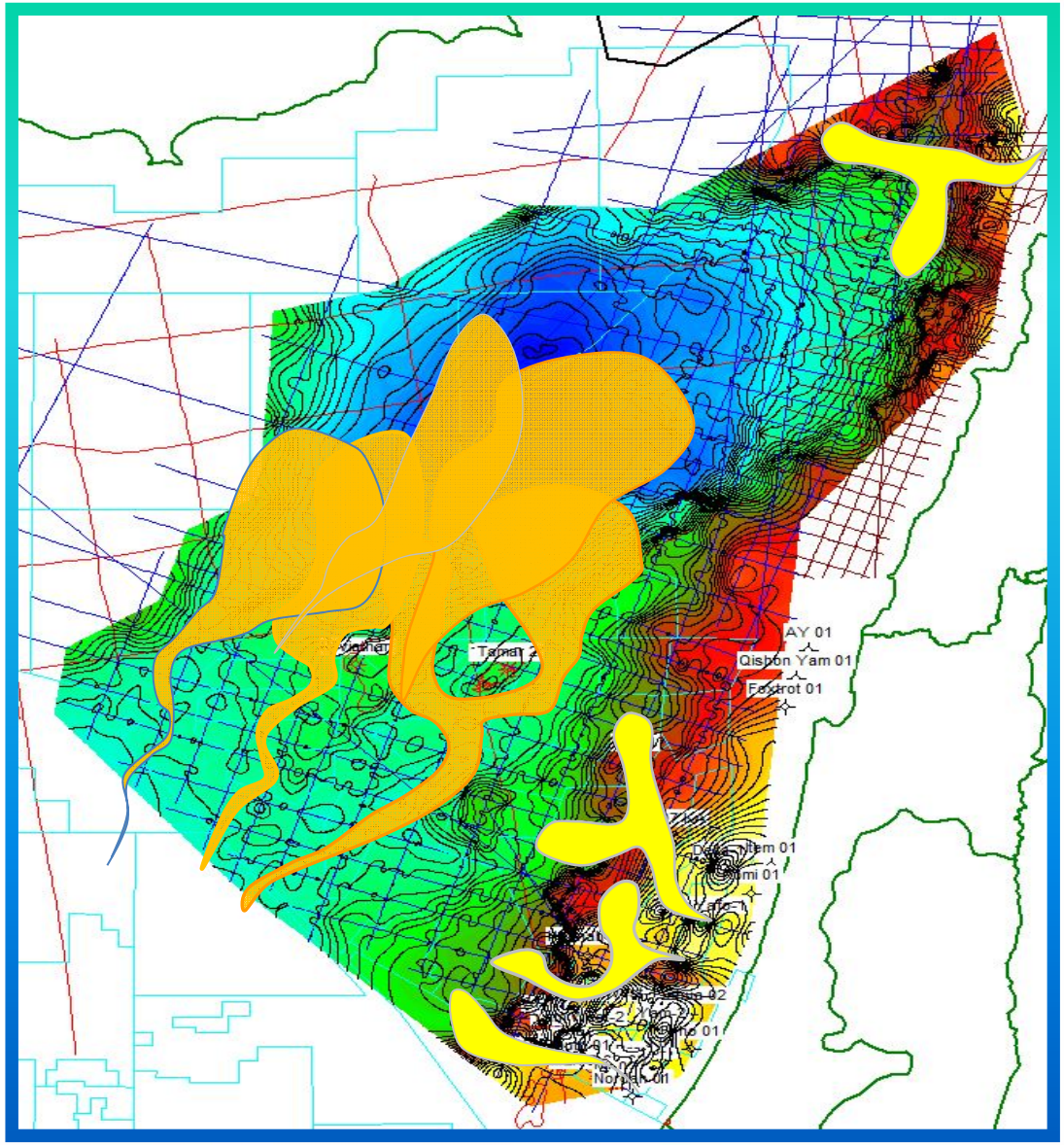
Levant Ramp



Syrian Arc Sand Provenance Fairways

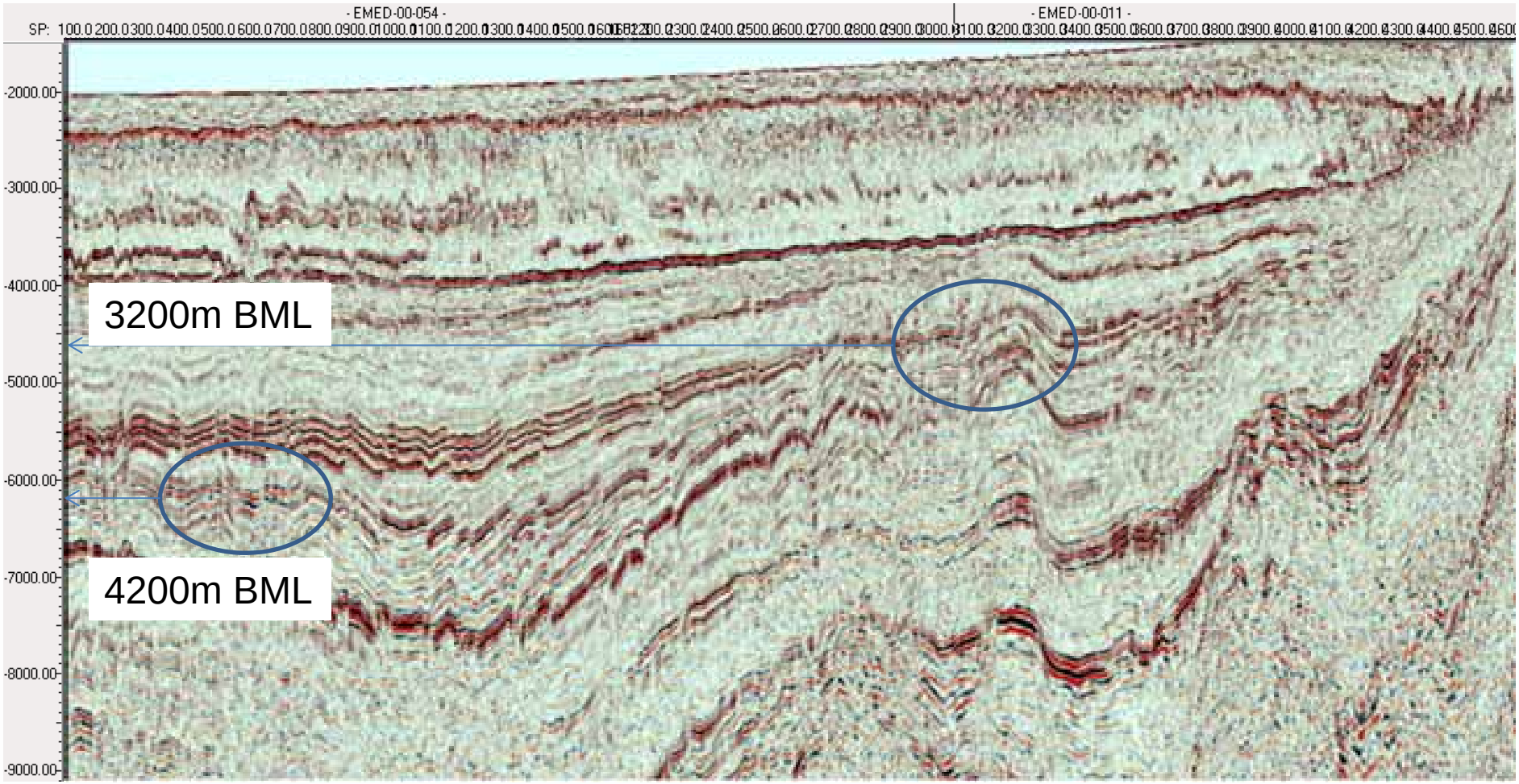


Sand Provenance



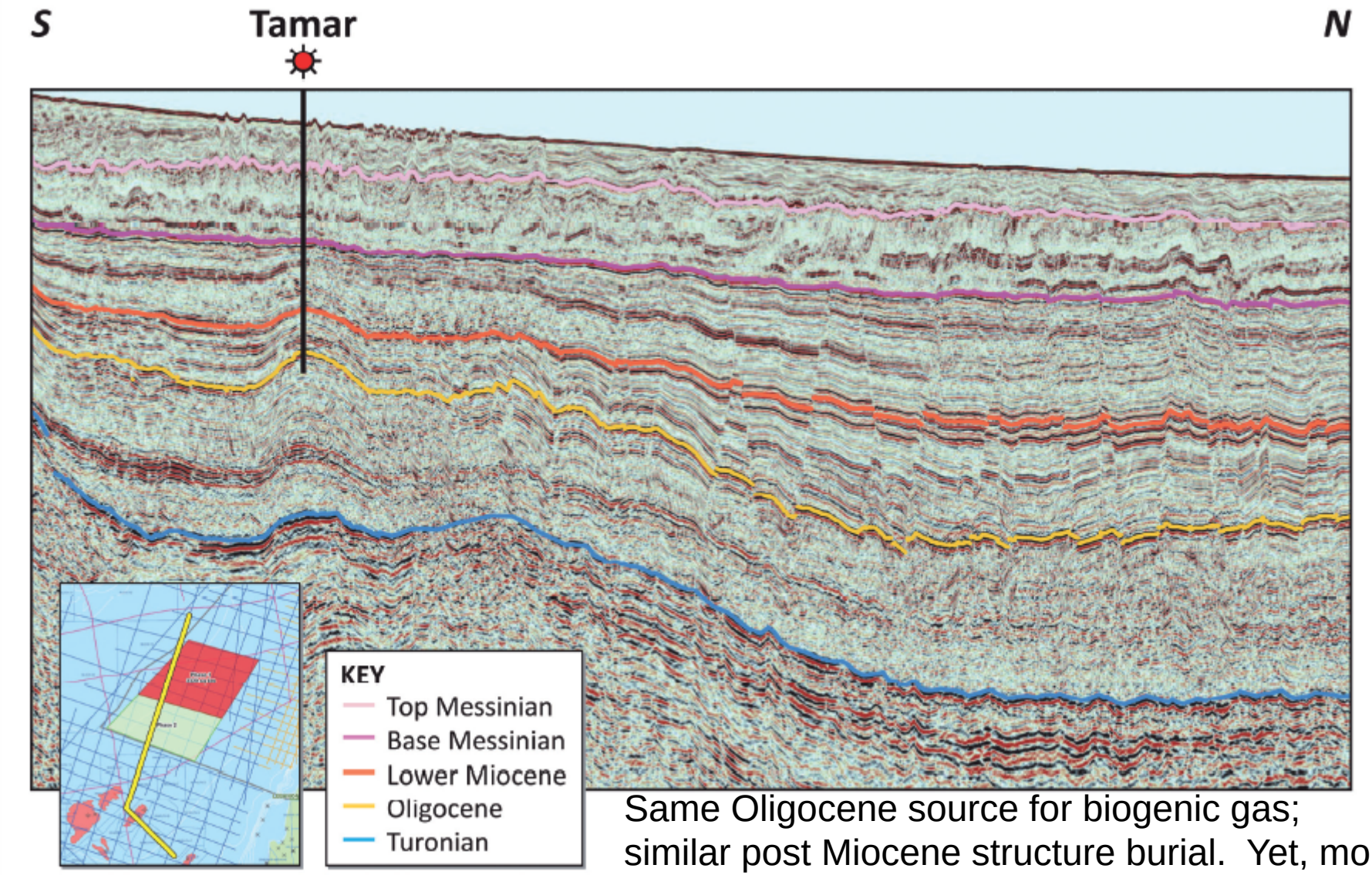
After Peace,
Petex Nov 2012

Sand Quality



2D data PSDM in Depth

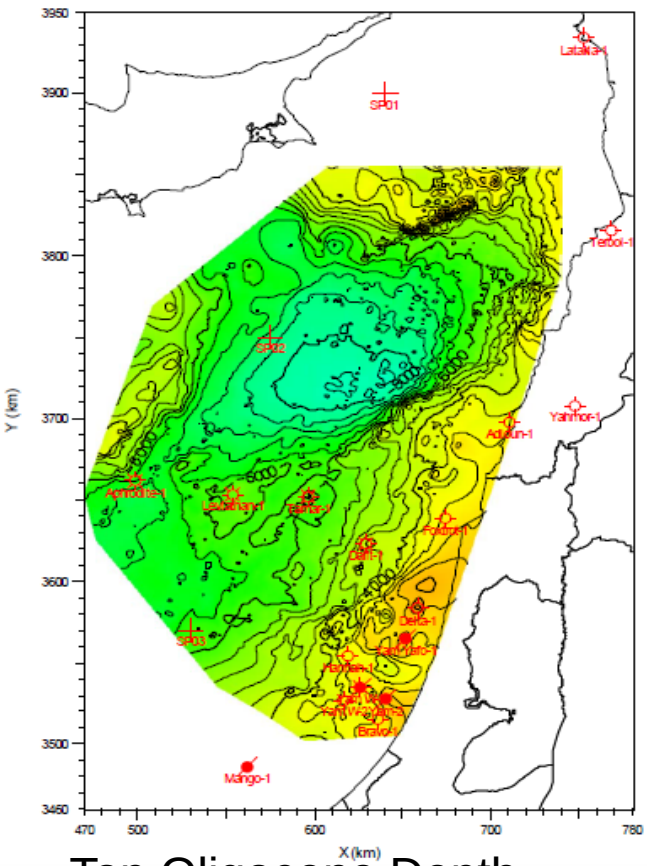
Extrapolating from southern Levant, northwards into south Lebanon



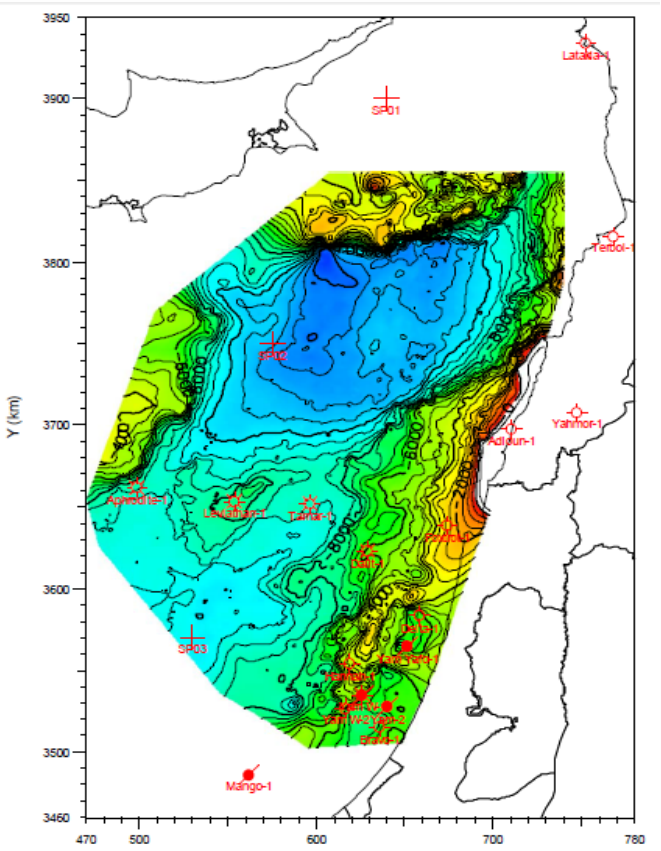
Same Oligocene source for biogenic gas; similar post Miocene structure burial. Yet, more intriguingly…

3D Basin Modelling: North Levant

- Oligocene immature even for oil beneath Tamar yet Mature and expelling oil in North Levant Basin since Messinian times.
- Mesozoic source is thermogenic Gas Mature in North Lebanon

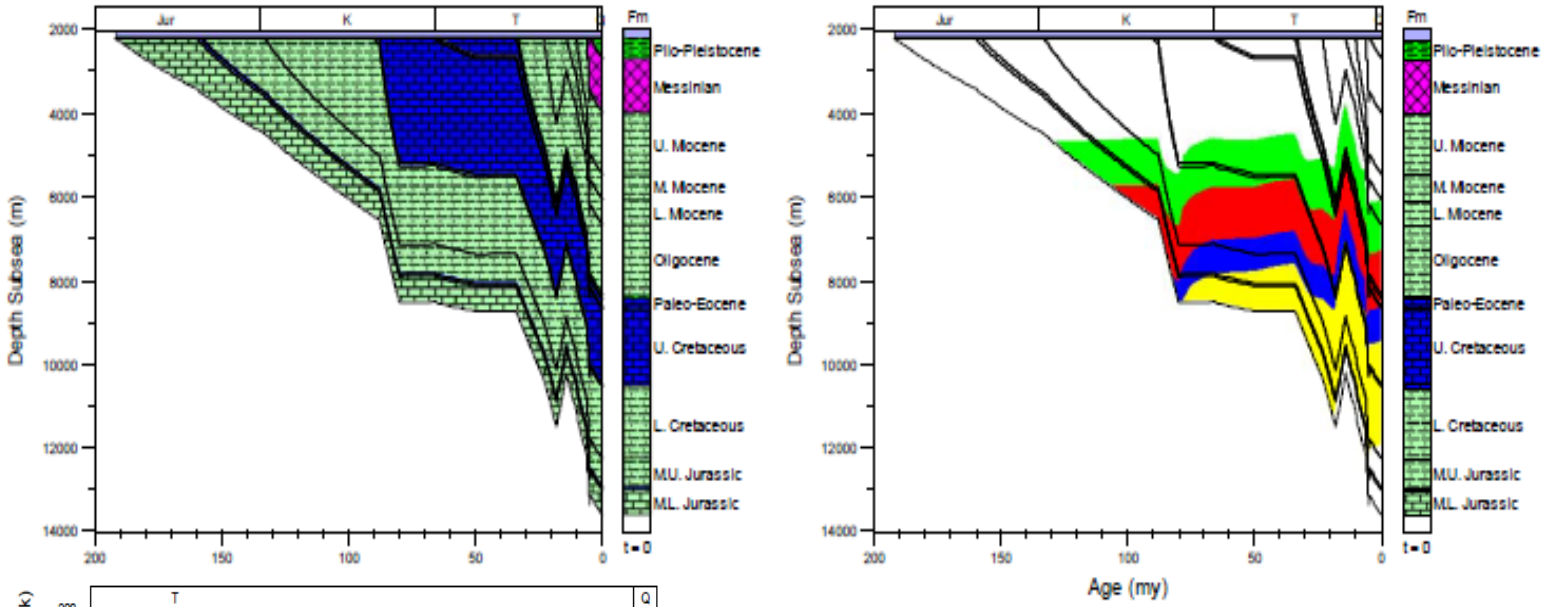


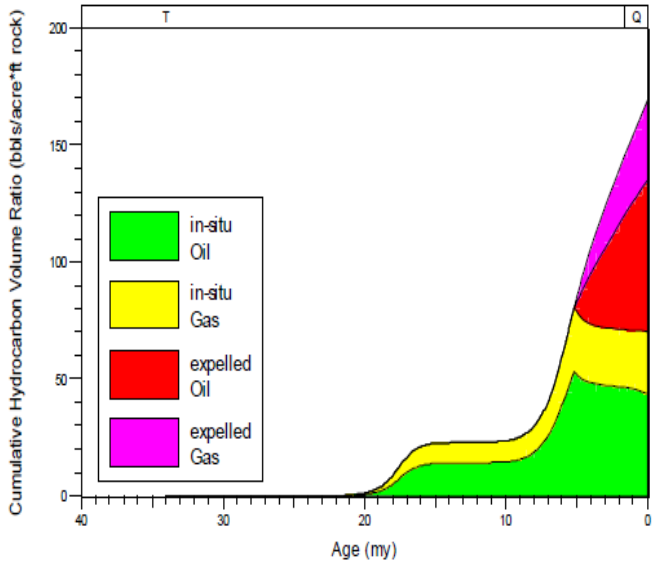
Top Oligocene Depth



Top Turonian Depth

3D Basin Modelling: North Levant





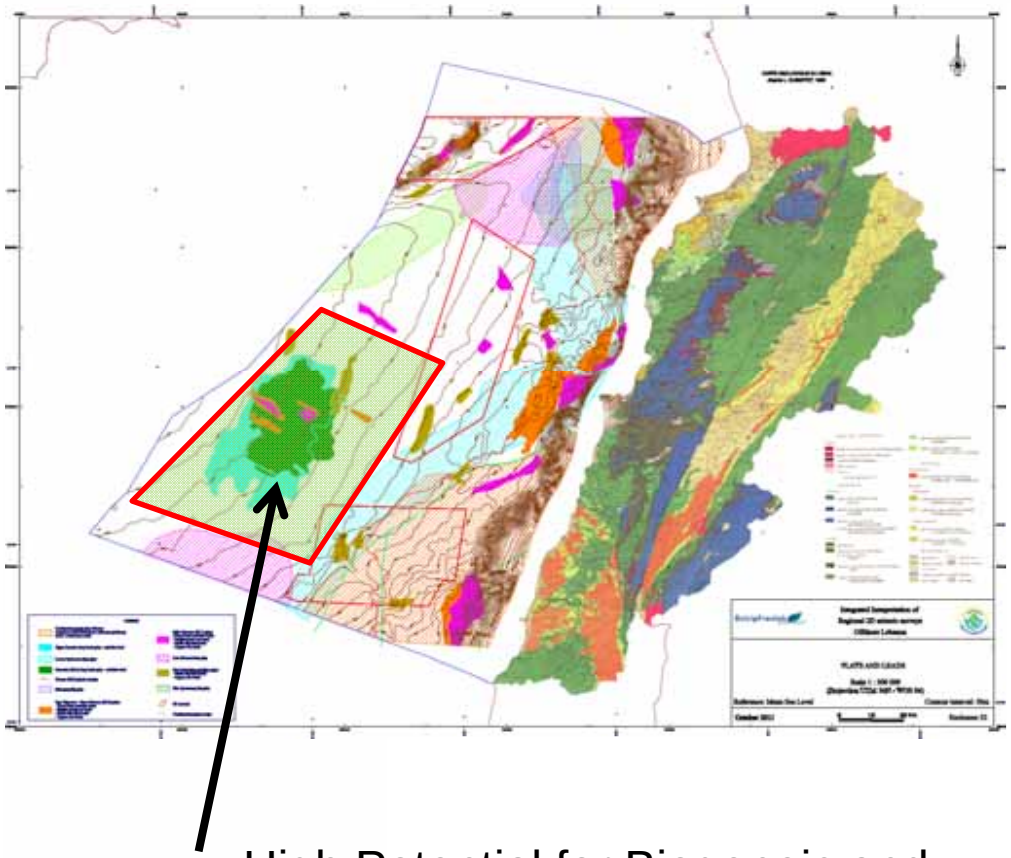
Oligocene Oil and Gas Source
Expelling oil from Messinian times to recent

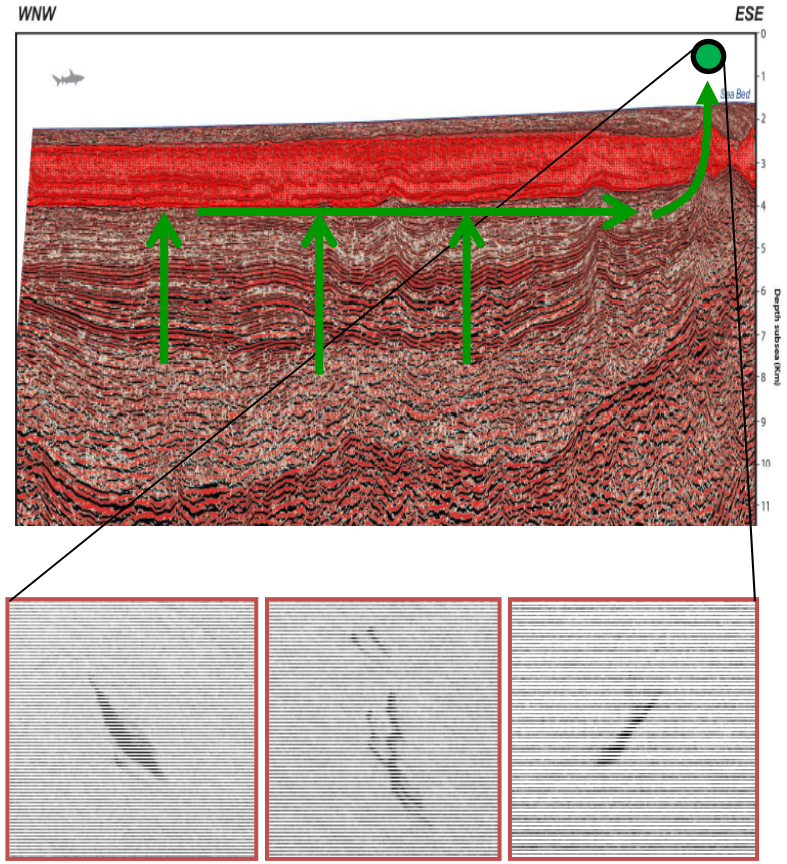
Independent basin modelling study based on all regional seismic data

BeicipFranlab

CONCLUSIONS on PETROLEUM SYSTEMS

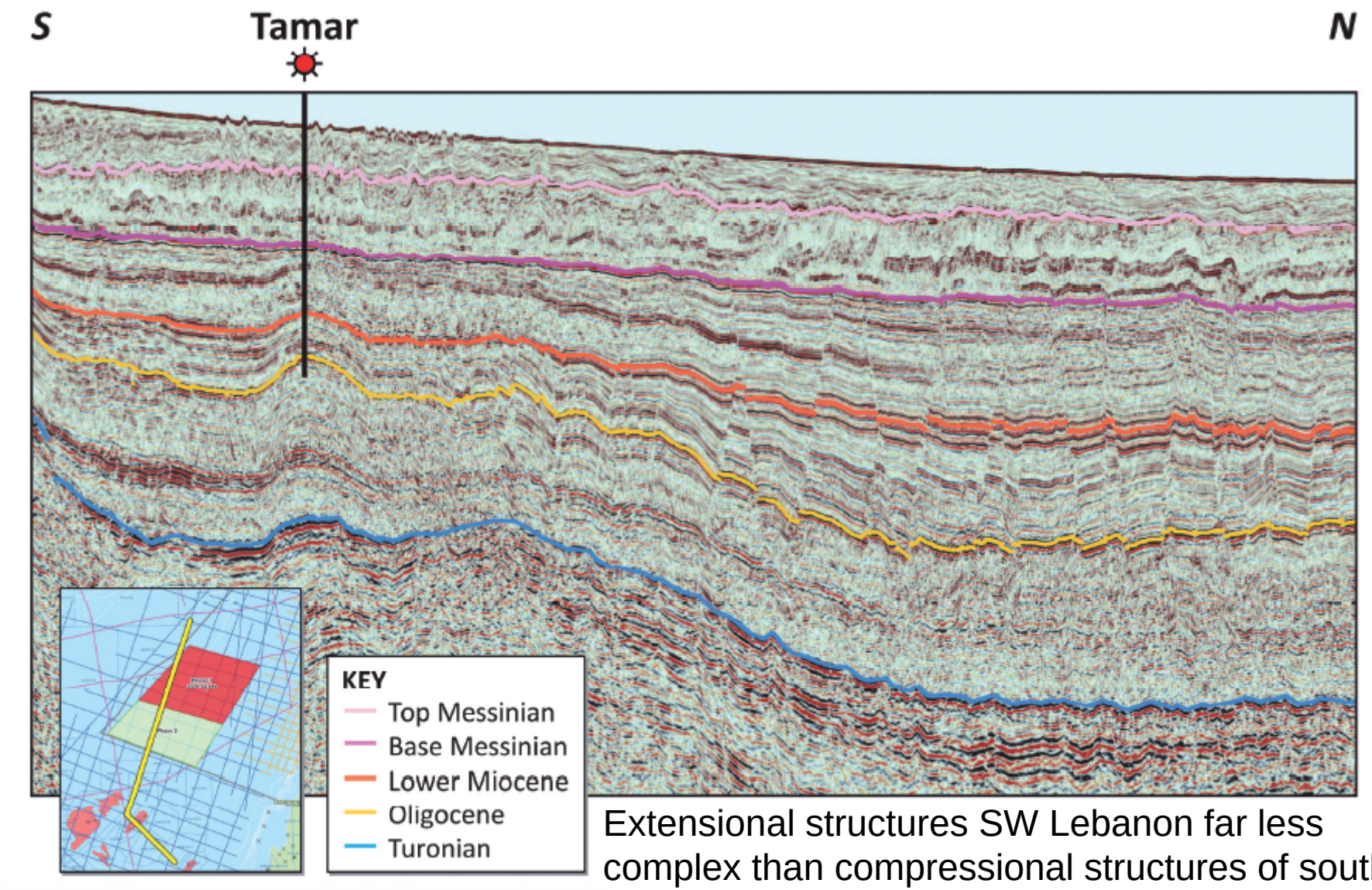
U. Cretaceous Thermogenic System





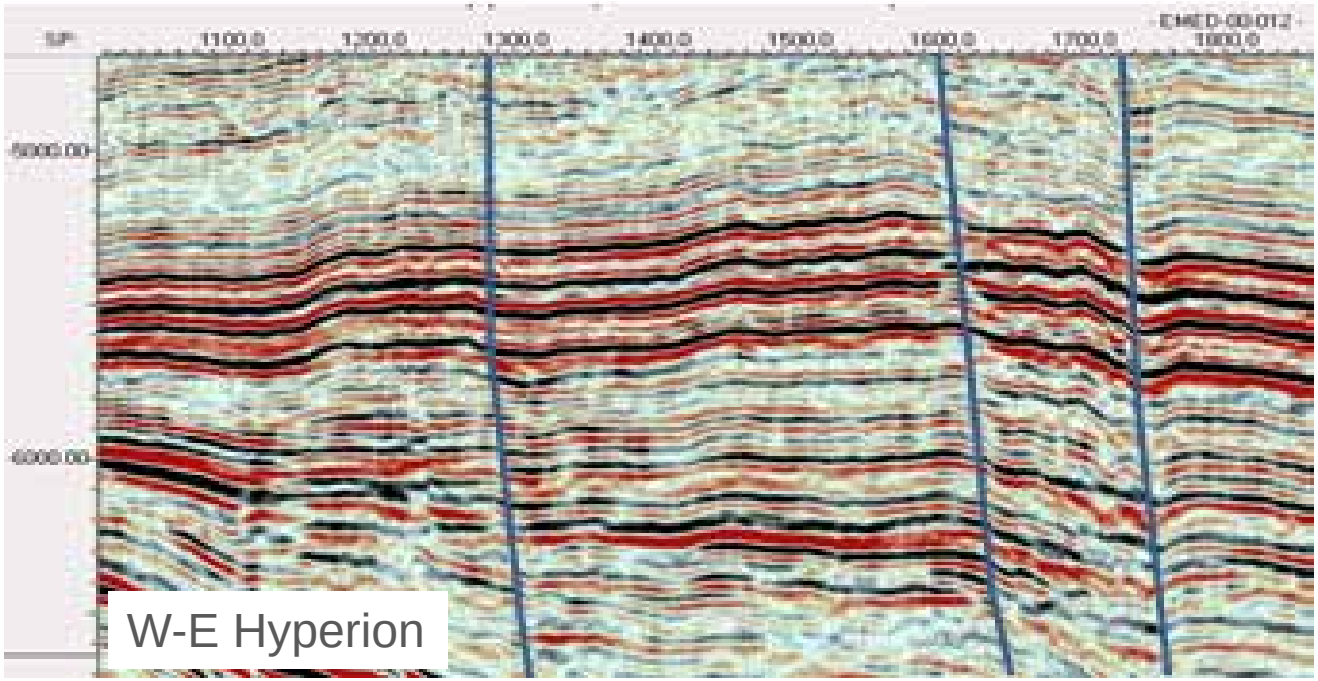
High Potential for Biogeneic and Thermogenic Gas

Extrapolating from southern Levant, northwards into south Lebanon

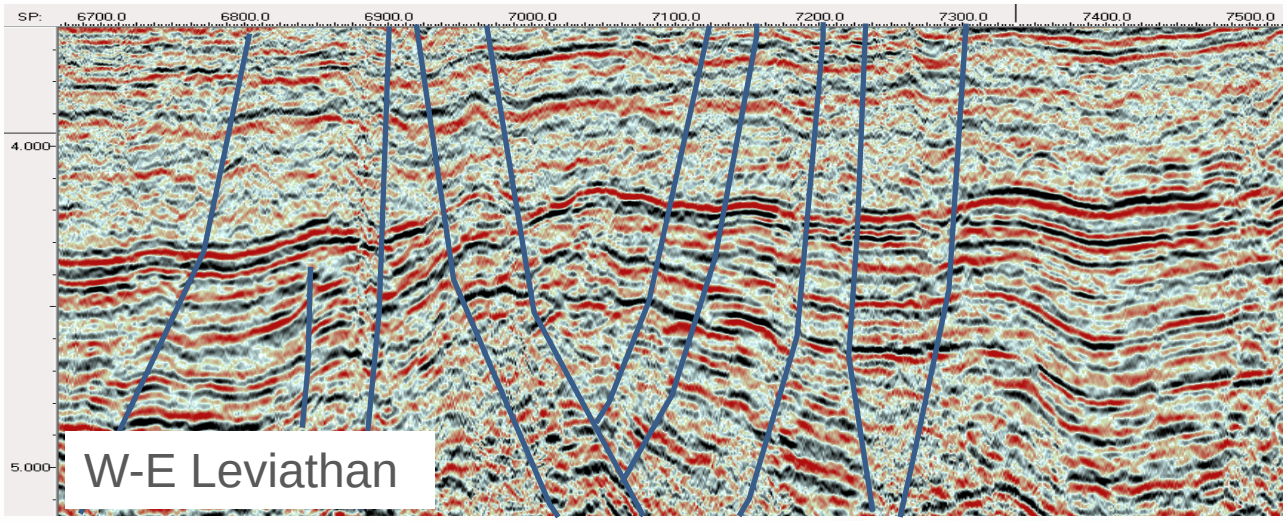


Extensional structures SW Lebanon far less complex than compressional structures of south Levant Basin

Structure



W-E Hyperion



W-E Leviathan

Comparative structure N and S levant Basins

Leviathan and Hyperion at the same horizontal scale

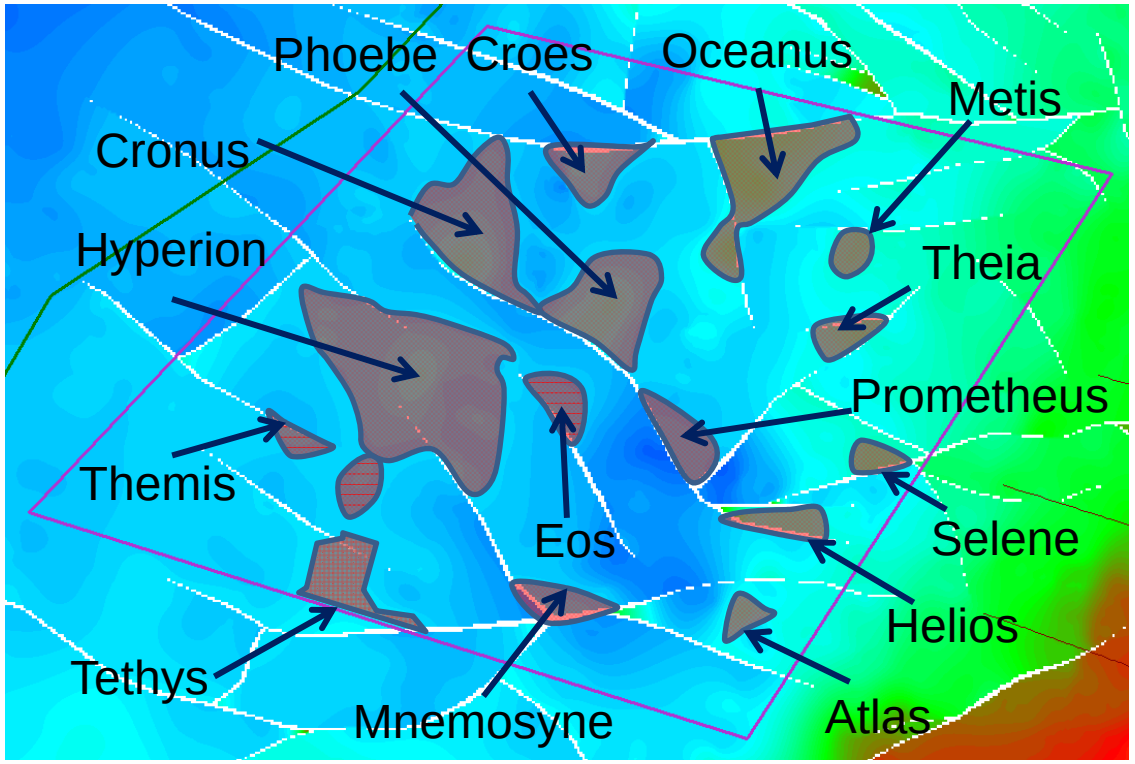
W-E line showing far greater complexity in the Leviathan structure:- 20 TCF

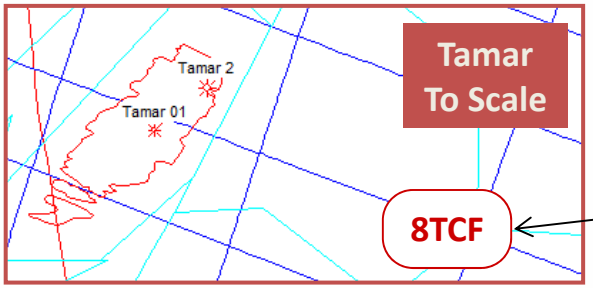
Prospectivity under 1st Phase

Assuming all dry gas

20 TCF (3.5 bn bbls OE)

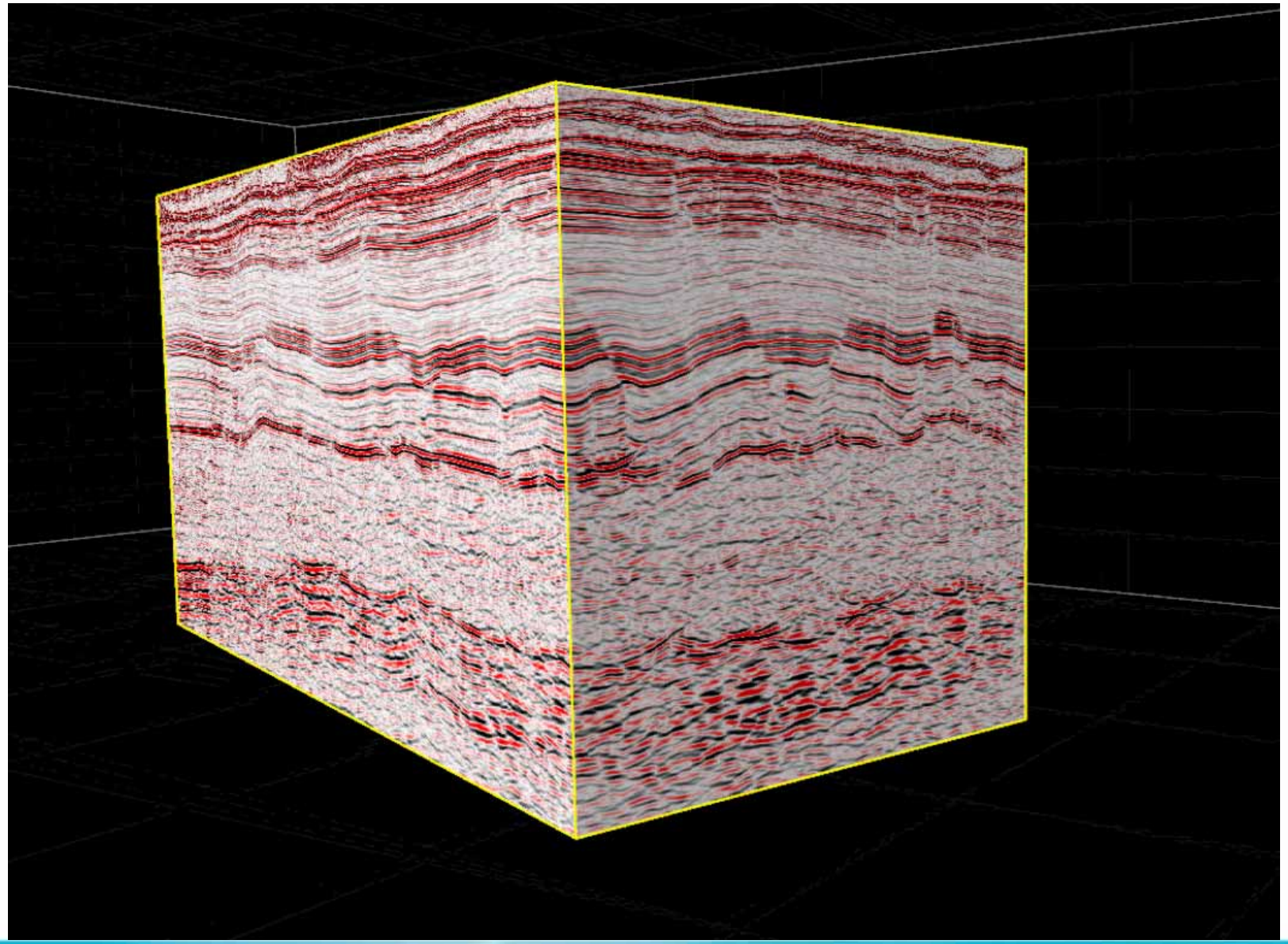
	Sq Km	Recoverable TCF
Oceanus	52	3.2
Hyperion	131	4.0
Cronus	68	3.0
Phoebe	36	1.5
Tethys	28	1.2
Croes	20	1.0
Metis	7	0.3
Theia	6	0.3
Prometheus	14	0.7
Selene	6	0.3
Atlas	5	0.2
Mnemosyne	15	0.7
Themis	7	0.3
Eos	12	0.6
	Sum:	20.0



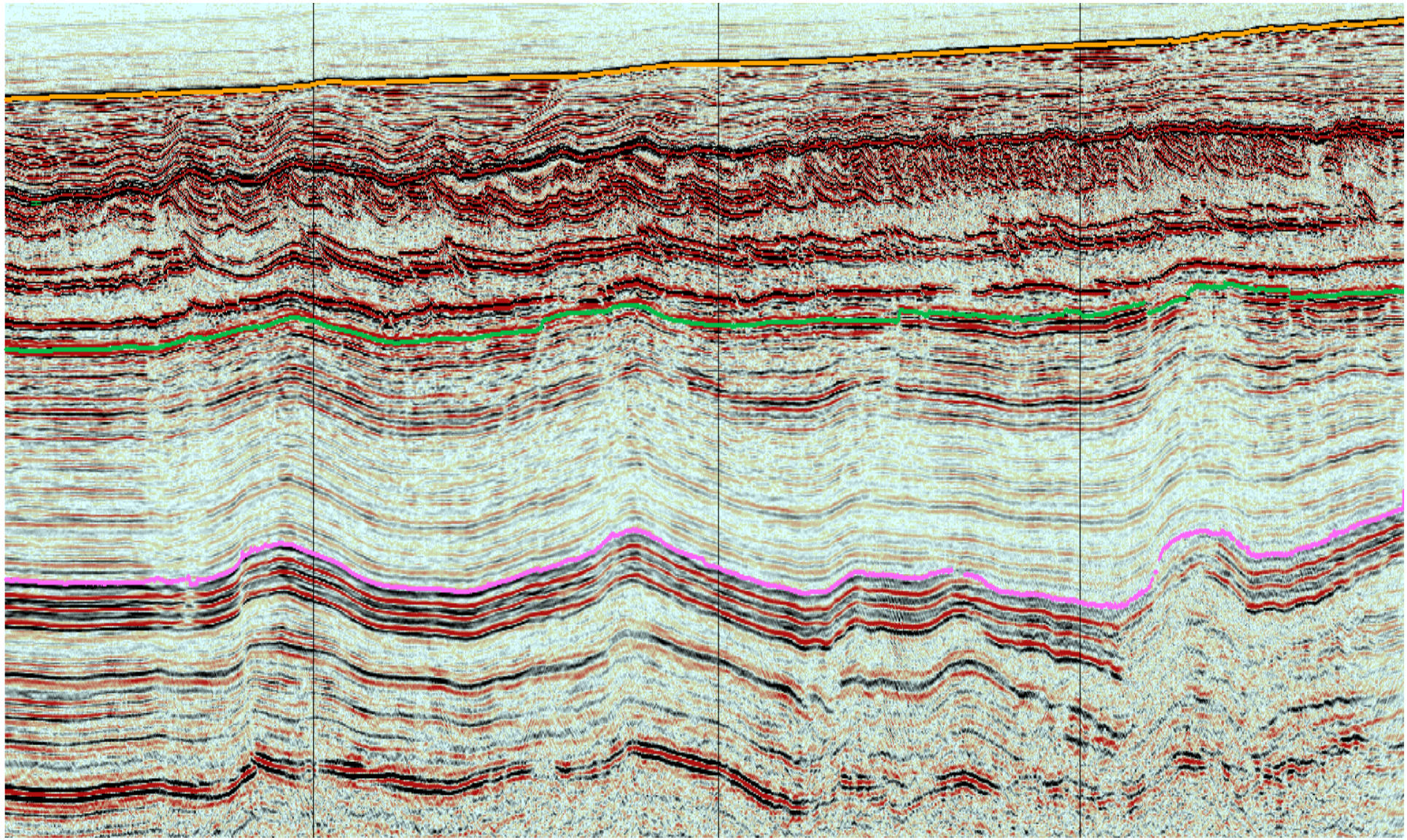


Multiple sands

Spectrum



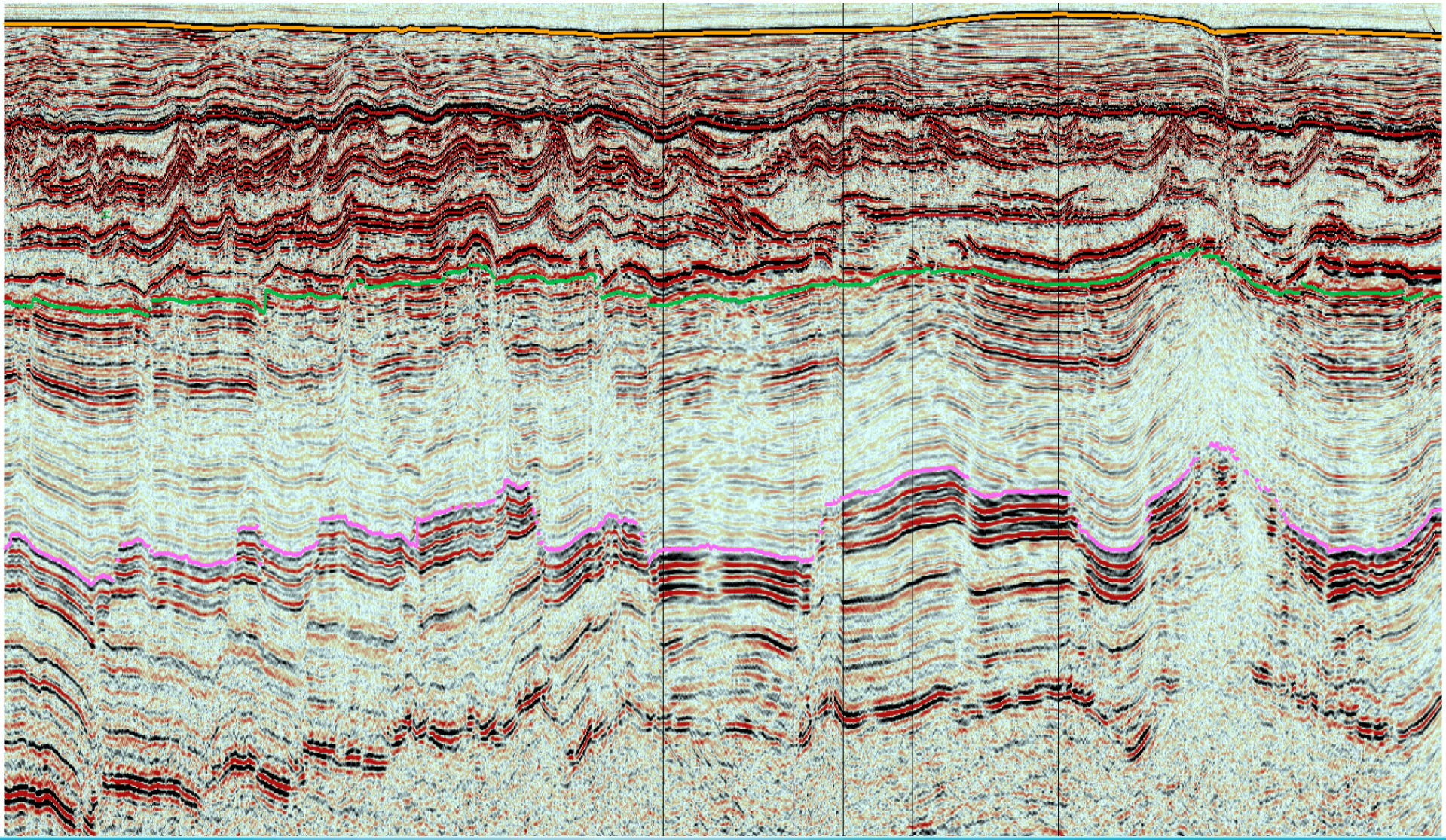
West to East Line through 3D area



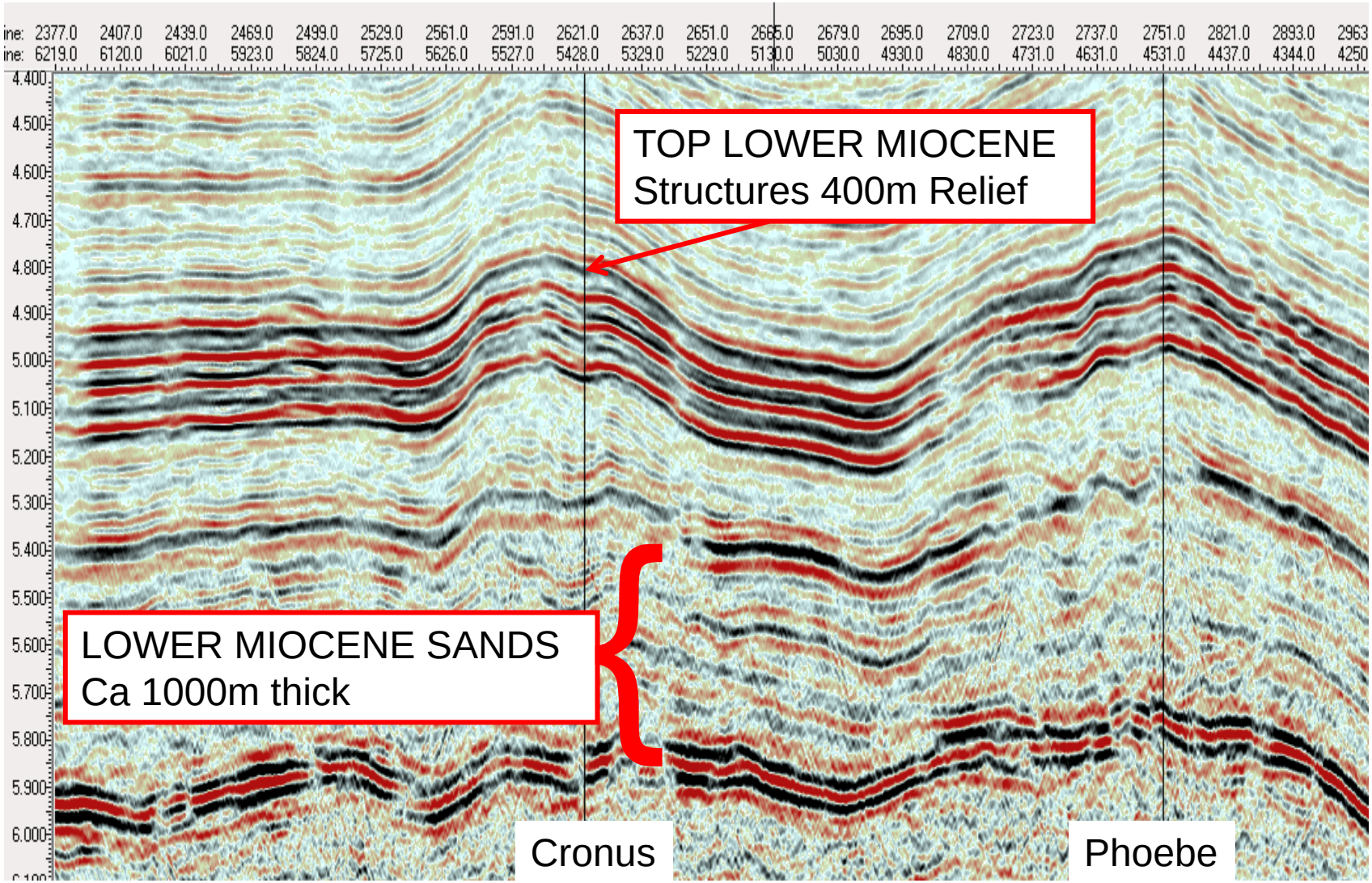
South to North Line through 3D area

Spectrum

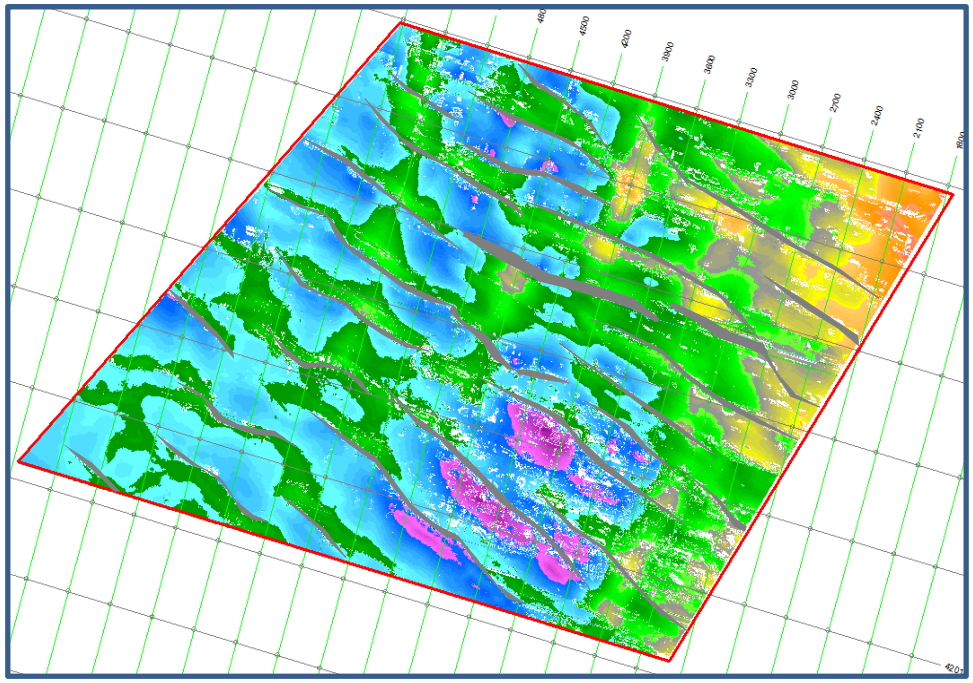
Hyperion Phoebe Oceanus

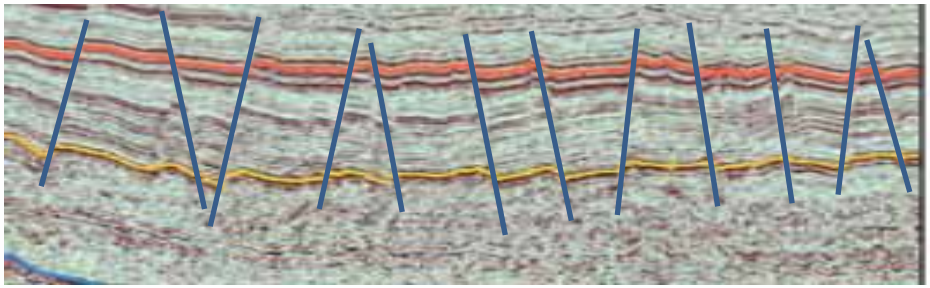


Top Lower Miocene Pick: Proxy for Lower Miocene Sand

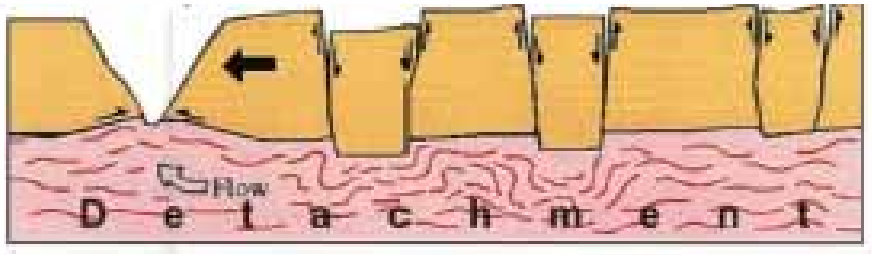


Top Lower Miocene TWT





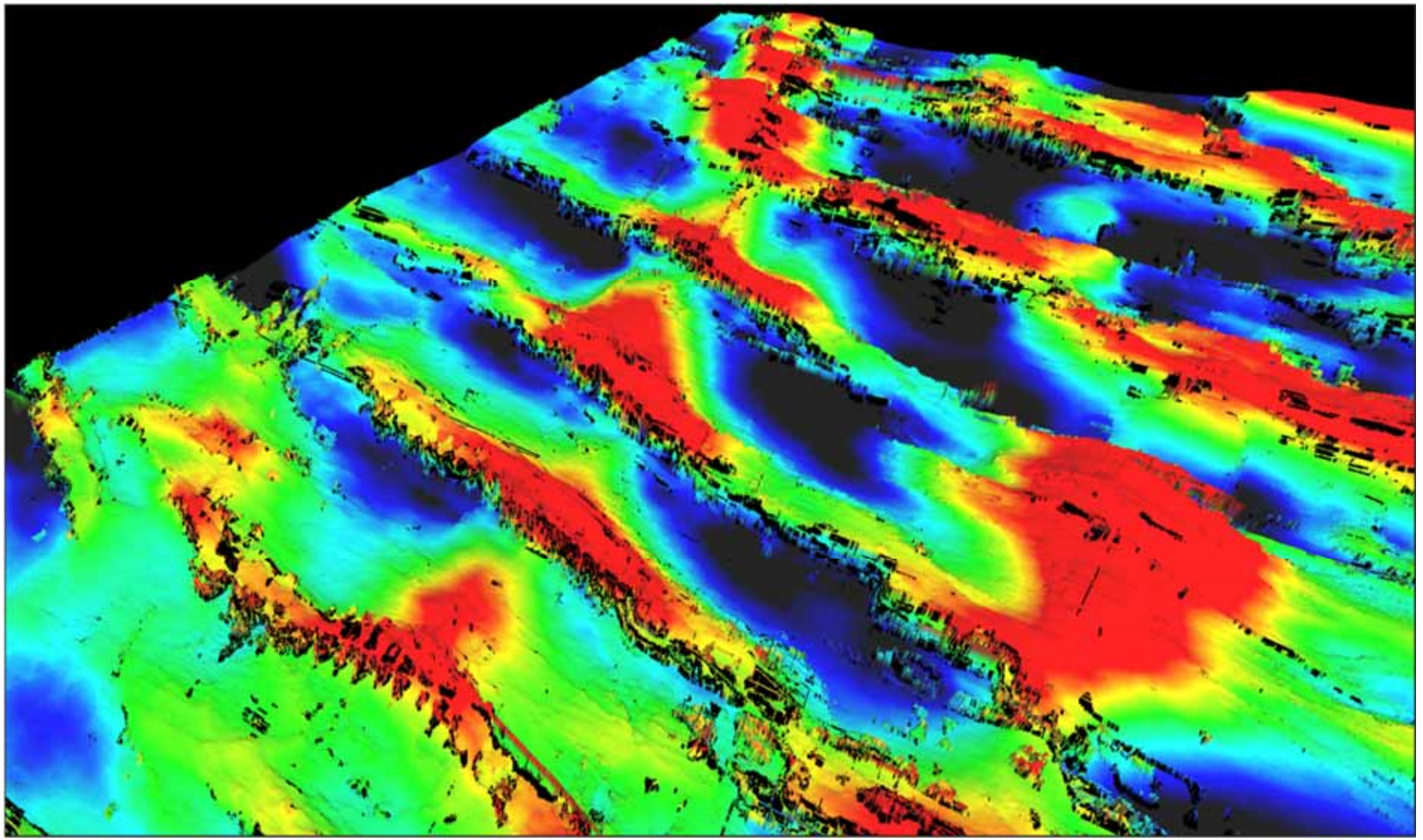
Lebanon 3D



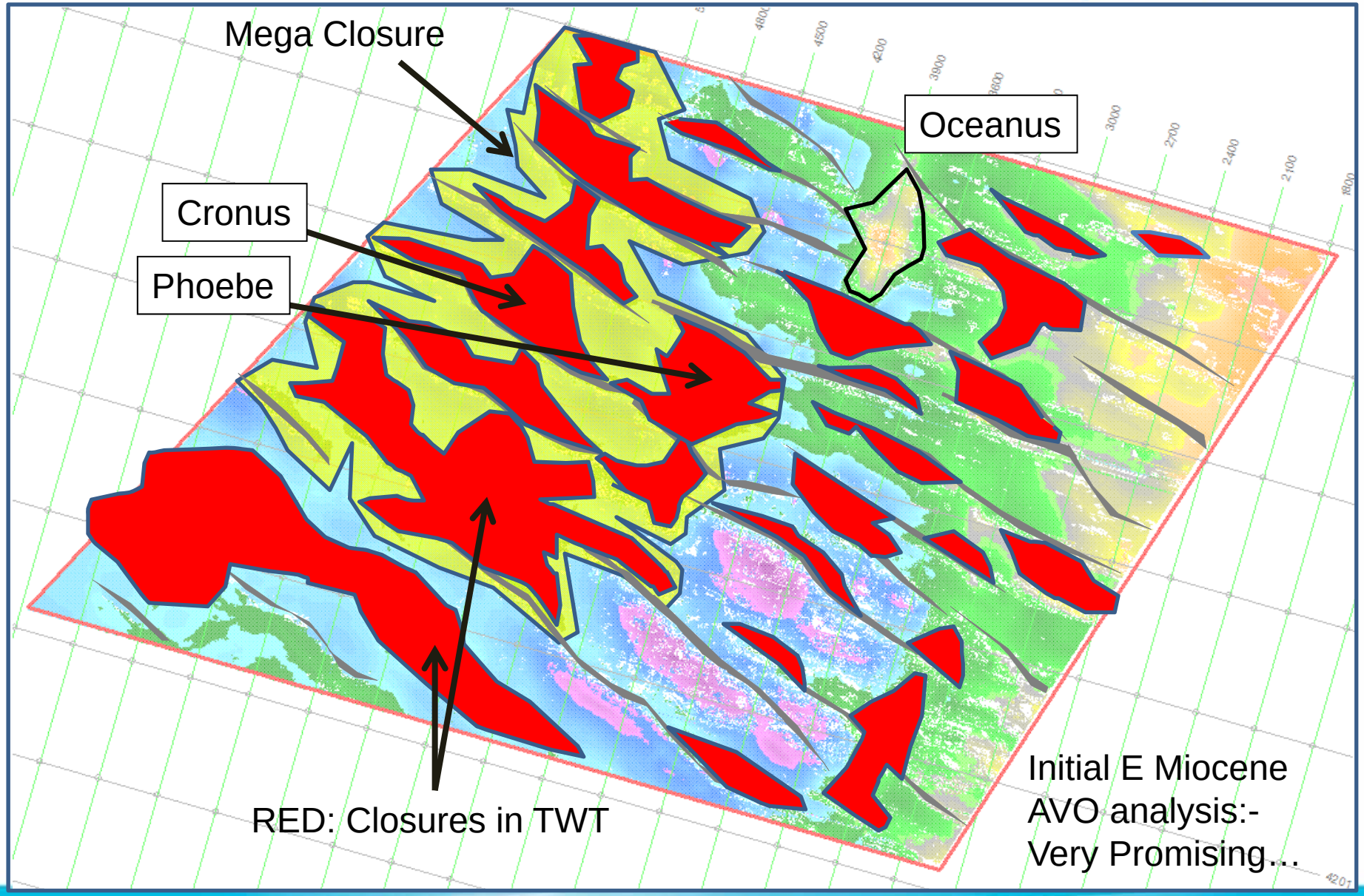
Canyonlands, Utah
(Tari et al, 2012)

Spectrum

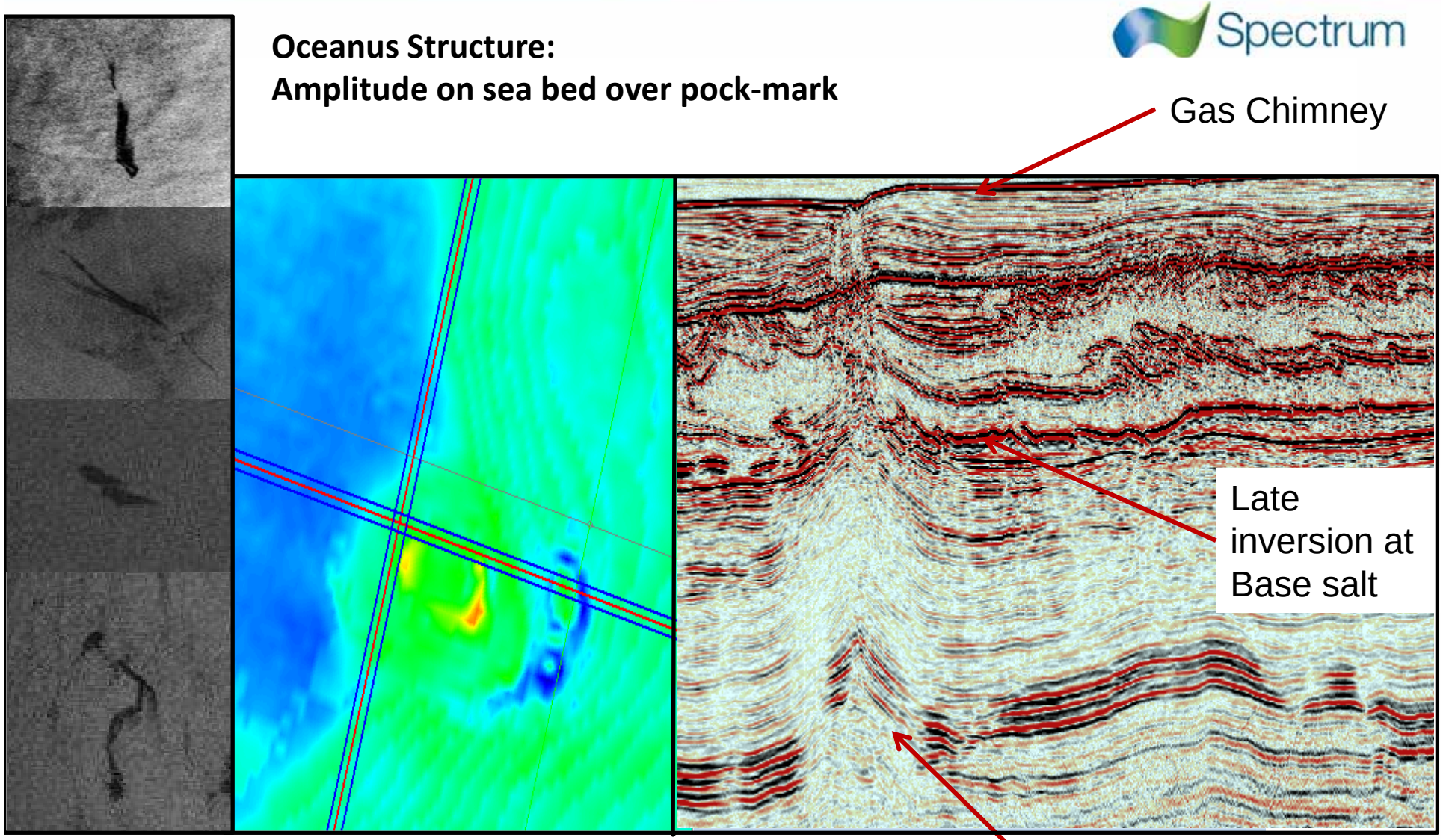
SW Lebanon 3D Seismic : Looking North - Top Early Miocene surface



Top Lower Miocene TWT



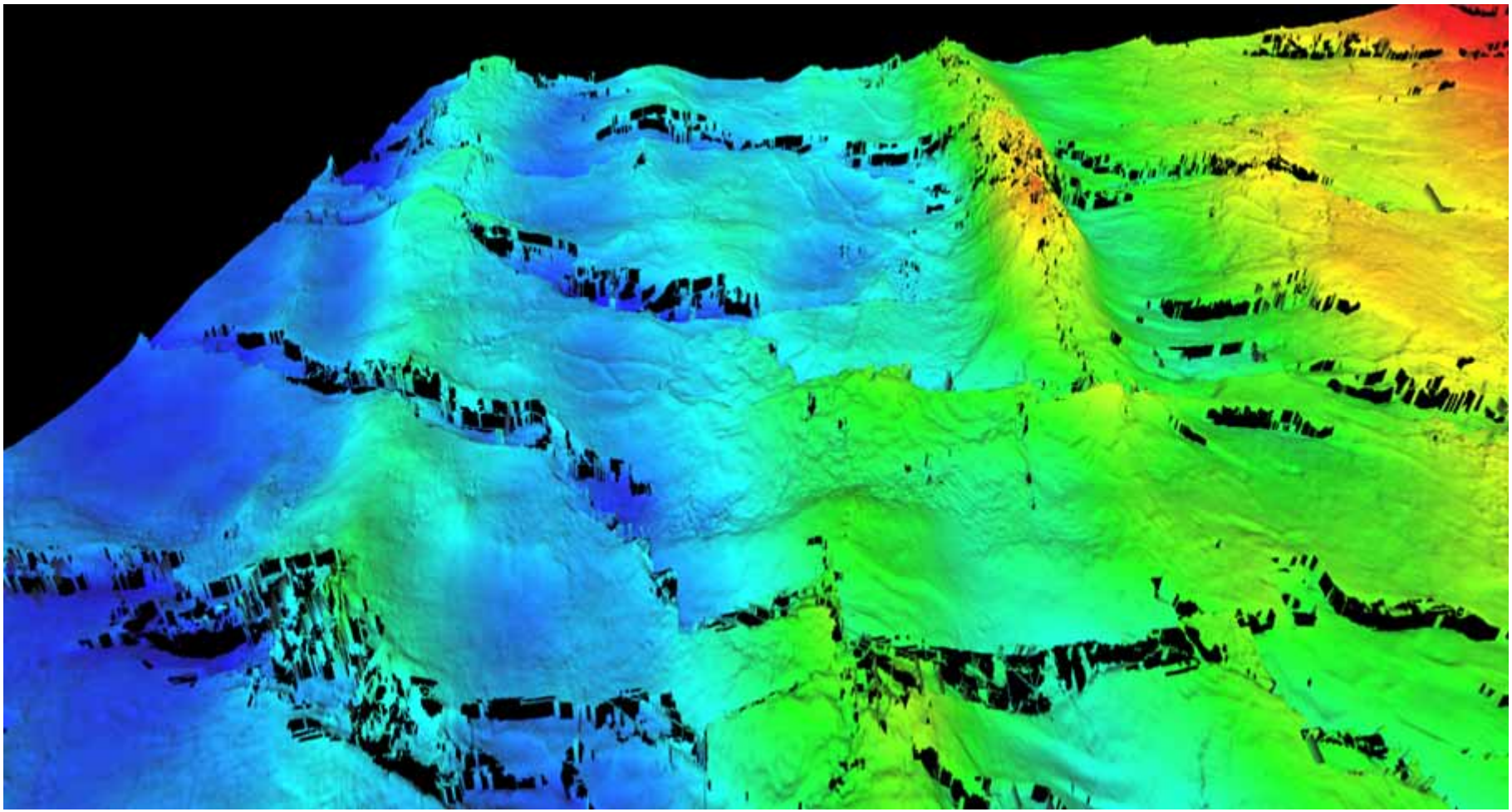
Oceanus Structure:
Amplitude on sea bed over pock-mark



Spectrum

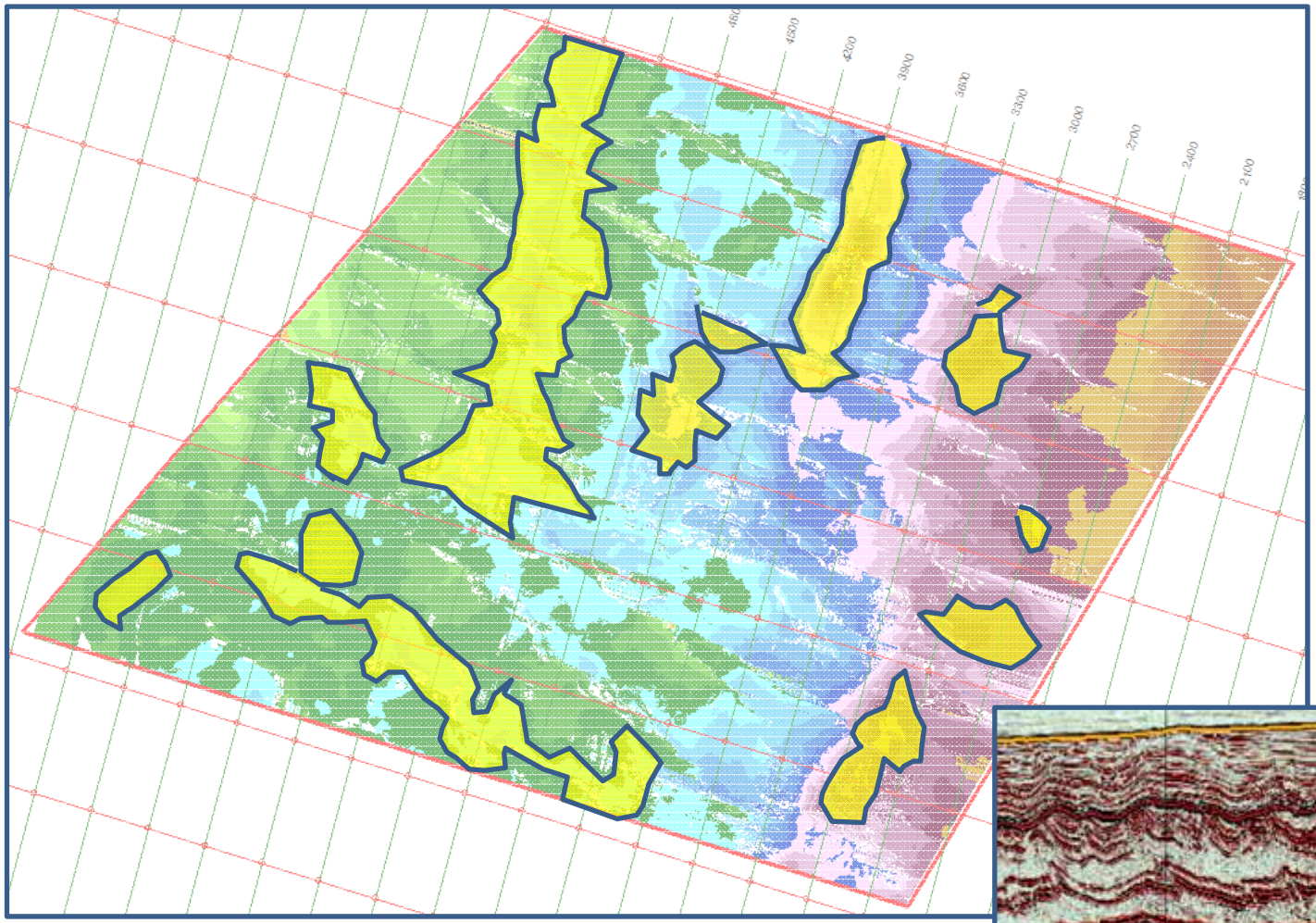
ASTRIUM
AN EADS COMPANY

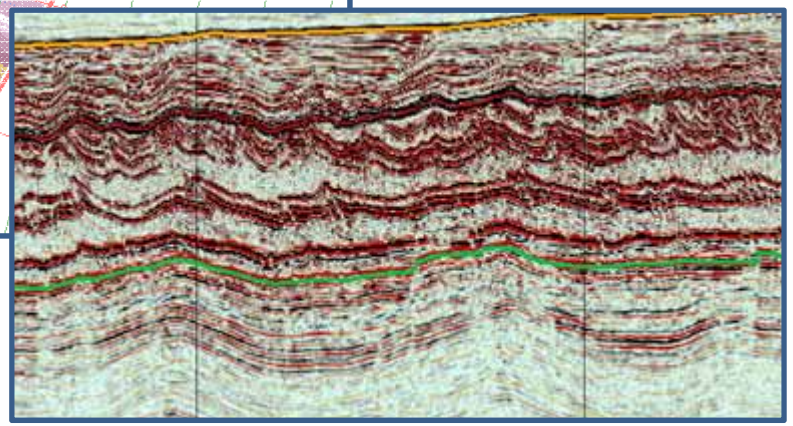
Looking North: Base Salt Surface TWT



New Play from 3D – Upper Miocene Clastics

Base Messinian Salt: Time Closures

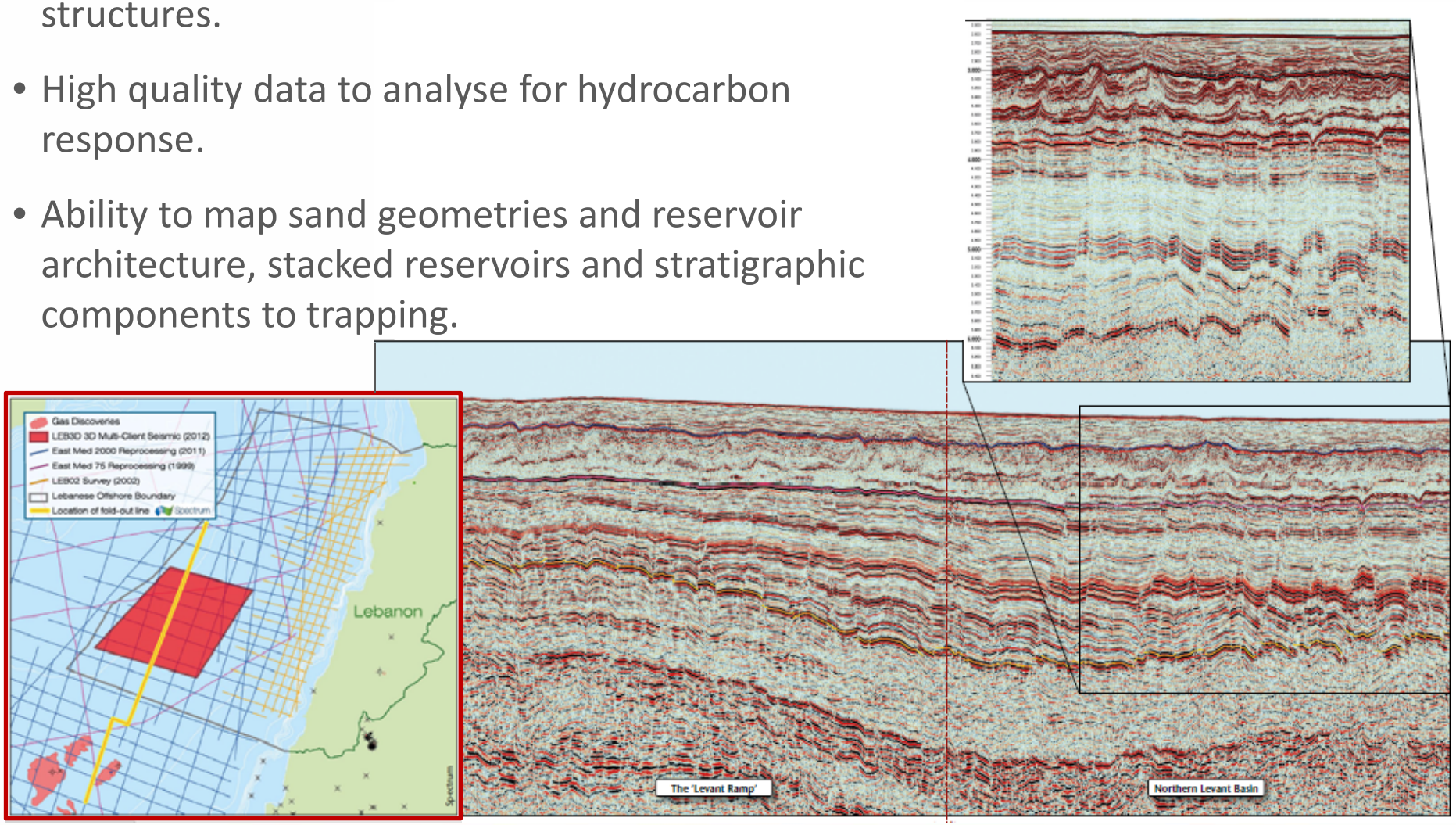




So what does the 3D do for us?

MC3D data offshore southern Lebanon is essential prior to bidding in 1st license round as it provides …

- Control to evaluate the size and potential of structures.
- High quality data to analyse for hydrocarbon response.
- Ability to map sand geometries and reservoir architecture, stacked reservoirs and stratigraphic components to trapping.



Q. Is there more than a biogenic gas play to chase in South Lebanon?

A. North Levant is an Oil and Gas Basin: Oil Seeps, Basin models and proven wet gas demonstrate a thermogenic source in the basin.

Q. Is the Best Miocene reservoir located in South Lebanon?

A. Miocene channels transported sand from the south depositing a sequence three times thicker in the Lebanese basin.

Q. Are the best structures in South Lebanon?

A. South Lebanon has bigger and less complex structuring than south Levant, located within the Spectrum 3D area .

3D reveals offshore Lebanon will be a major new oil and gas province.

Time to Pre-qualify!