

2ND CYPRIOT-GREEK OIL & GAS 2013 SUMMIT

LIMASSOL, 18-19 APRIL, 2013

THE HYDROCARBON POTENTIAL OF OFFSHORE CYPRUS

**IN THE CONTEXT OF EASTERN MEDITERRANEAN
CONTINENTAL MARGIN GEOLOGY**

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PetroServ (CY) International, LLC.

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THE REGIONAL CONTEXT

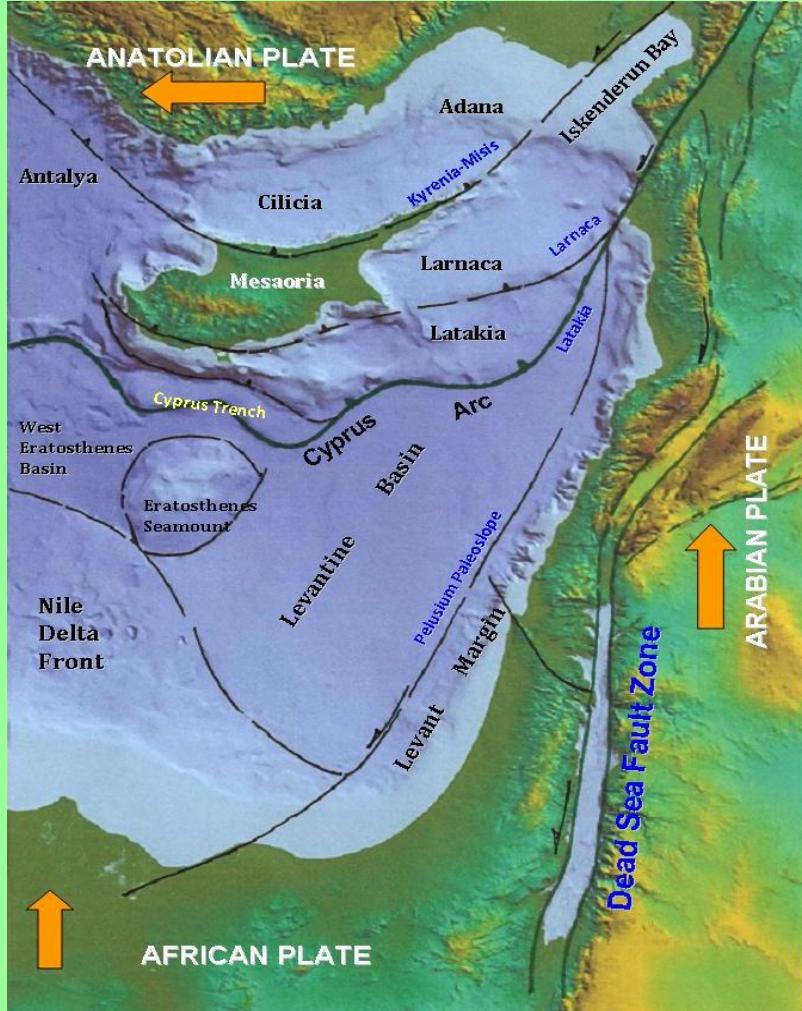
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Eastern Mediterranean sedimentary basins



**** African Plate Basins:**

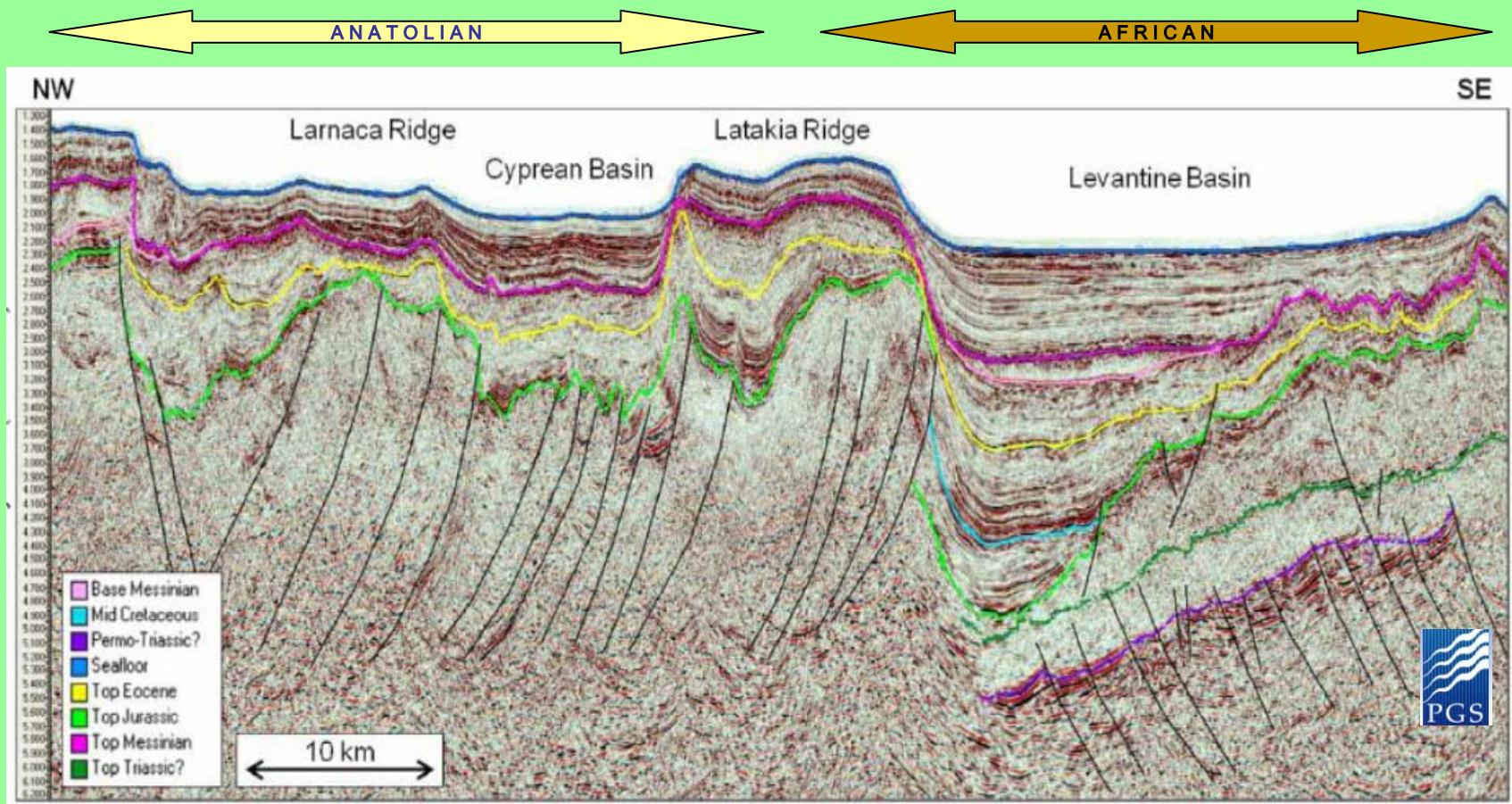
- Levant Margin (the African coastal areas to the east)
- Levantine Basin
- Cyprian Arc Folds (north-eastern Cyprus)
- Eratosthenes Seamount
- Cyprus Trench
- West Eratosthenes Basin
- Herodotus Basin
- Nile Delta

**** Anatolian Plate Basins:**

- **East Cyprus Fore-Arc basins:**
 - Latakia,
 - Larnaca-Mesaoria
 - Iskenderun Bay
- **Mediterranean Turkey:**
 - Cilicia-Adana
 - Antalya

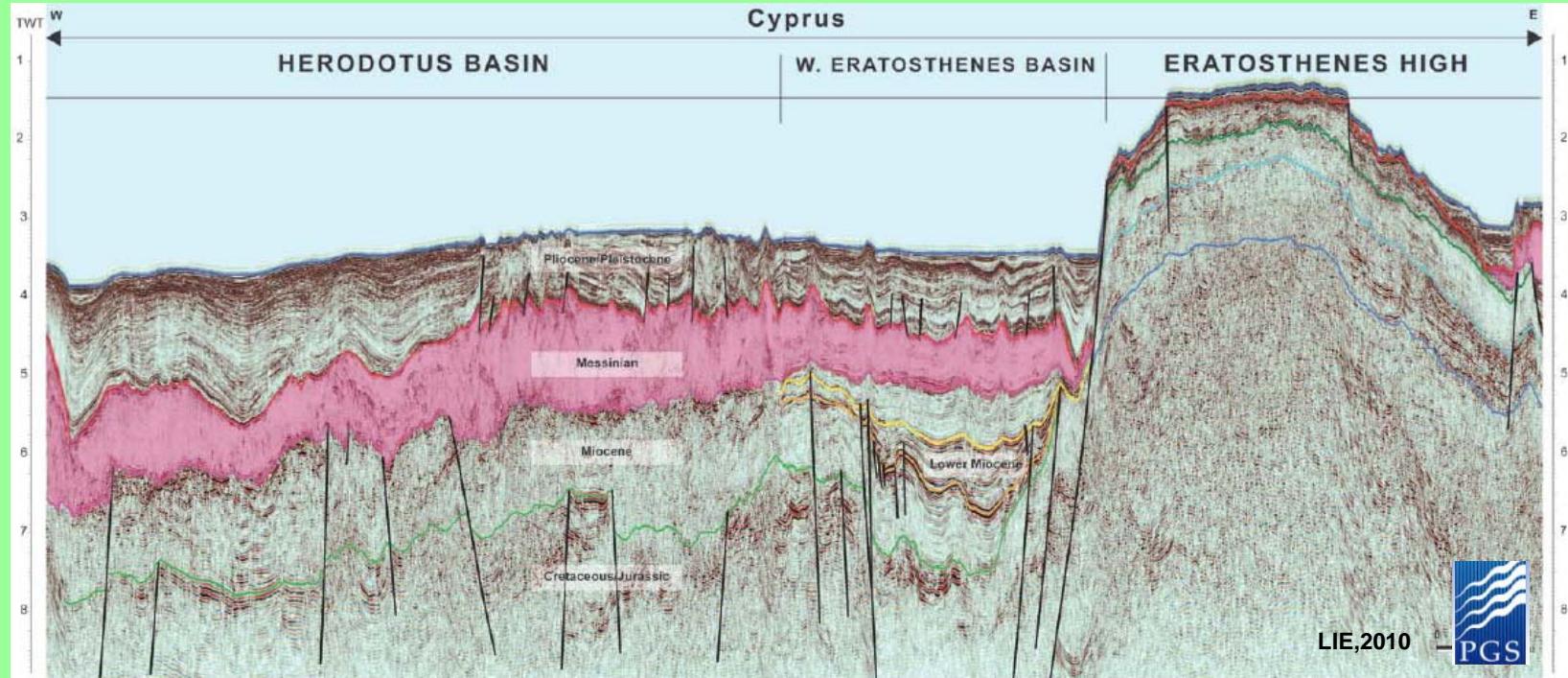


Anatolian vs African plate basins





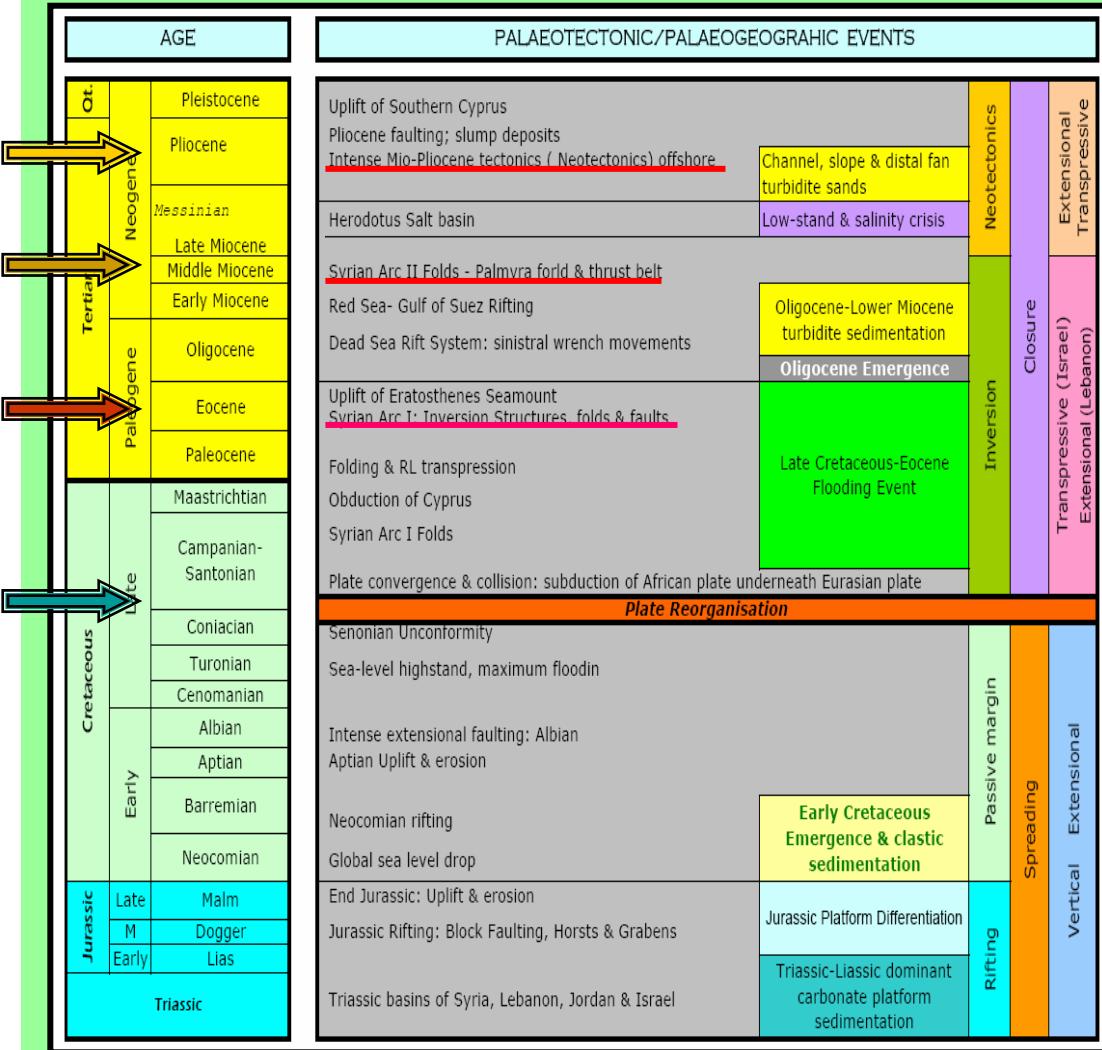
ESM, W. Eratosthenes & Herodotus basins





Geodynamics of the Levant Province

Paleotectonic Events



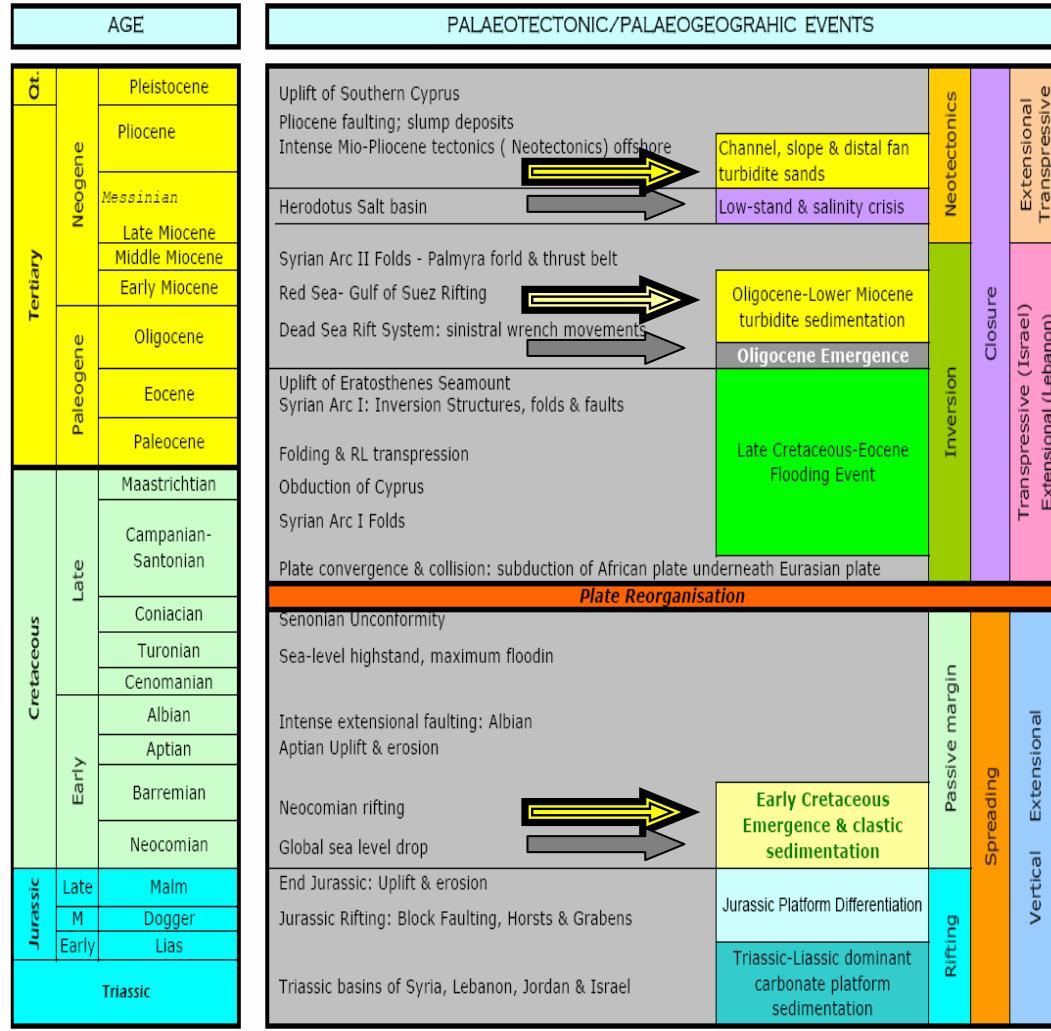
Five main tectonic events have modelled the geological evolution of this region:

- **Triassic-Middle Jurassic rifting (Tethys)**
- **Mid Jurassic-Late Cretaceous (Turonian): passive margin sedimentation**
- **Senonian plate reorganisation (Ocean closure)**
- **Late Cretaceous (Senonian)-Miocene: compressional tectonics and inversion (Syrian Arc folding); extensional tectonics (Lebanon)**
- **Late Neogene transpressional tectonics (Neotectonics)**



Geodynamics of the Levant Province

Paleogeographic Events

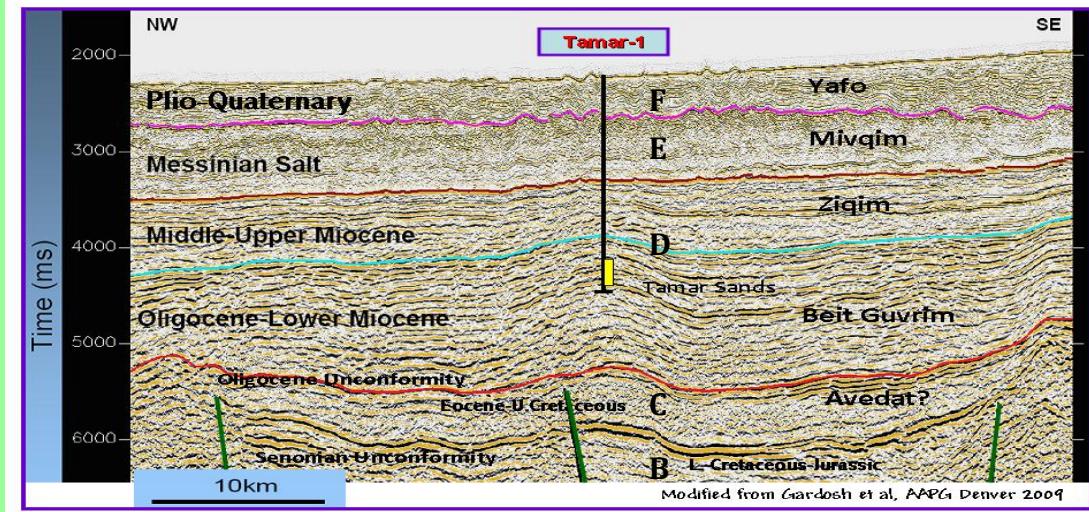
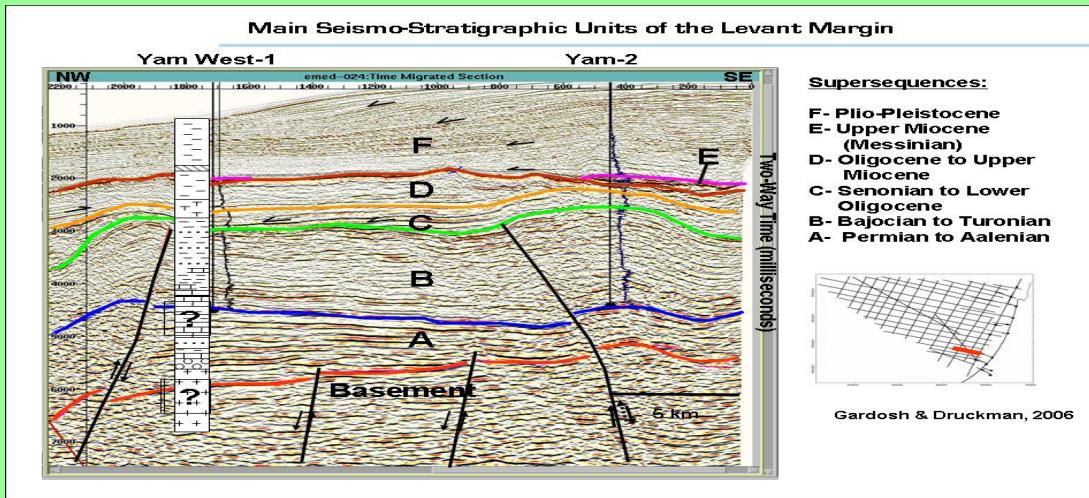


Key Events:

- Early Pliocene Low-stand
- Messinian Salt deposition
- Oligocene-Lower Miocene turbidite sedimentation
- Oligocene Emergence
- Late Cretaceous-Eocene Flooding
- Early Cretaceous Emergence & clastic sedimentation
- Middle Jurassic platform differentiation
- Triassic-E. Jurassic carbonate platform sedimentation (Tethys)



Seismic stratigraphy offshore Israel



- Thinning of Plio-Pleistocene offshore
- Thickening of Messinian salt offshore
- 3x thickening of Oligocene-Miocene sedimentary sequence westward:
- Sands missing or very thin in Levant Margin wells to the east
- Relatively thick turbidite sands in deeper Levantine Basin to the west.

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PROSPECTIVITY OFFSHORE CYPRUS

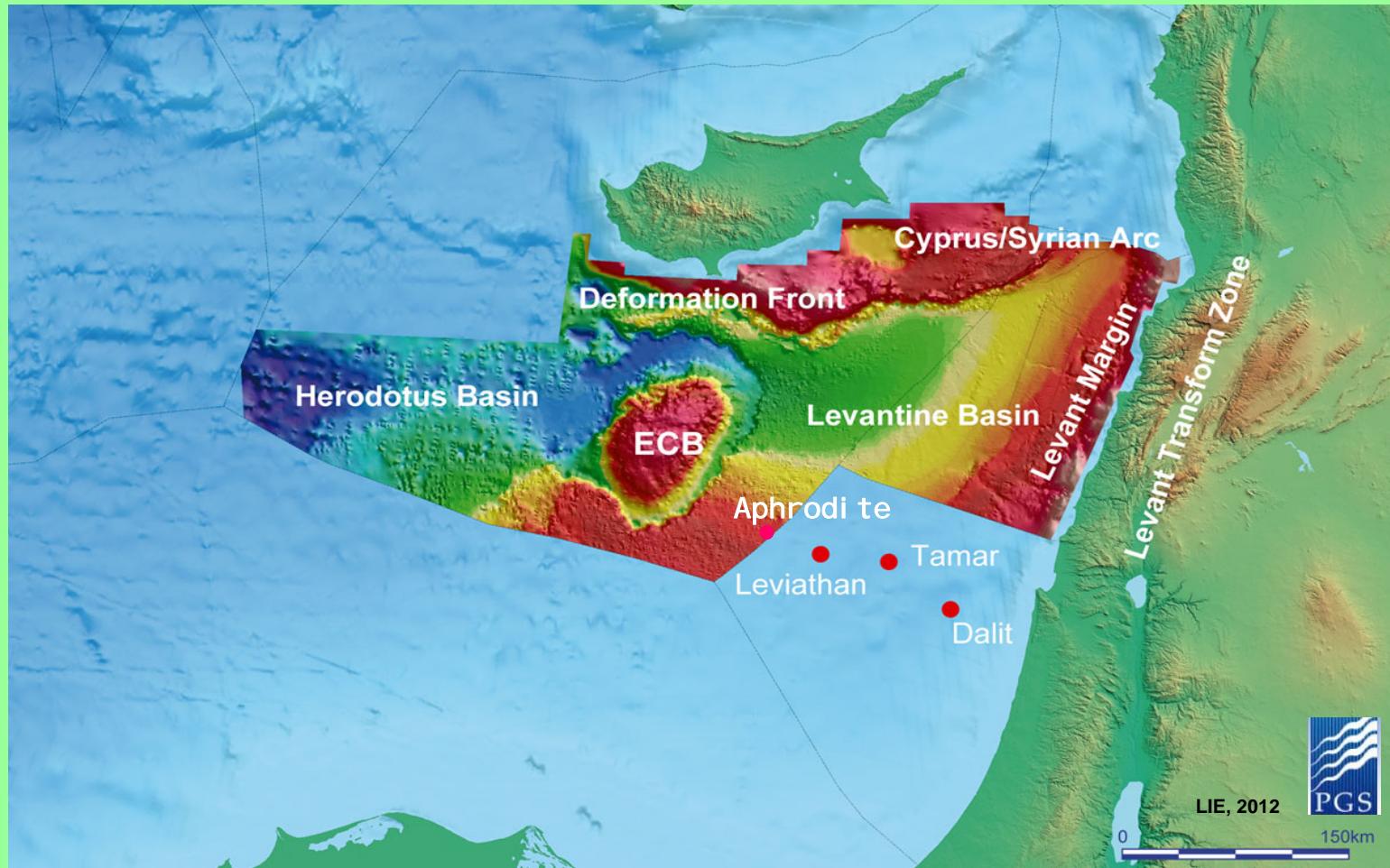
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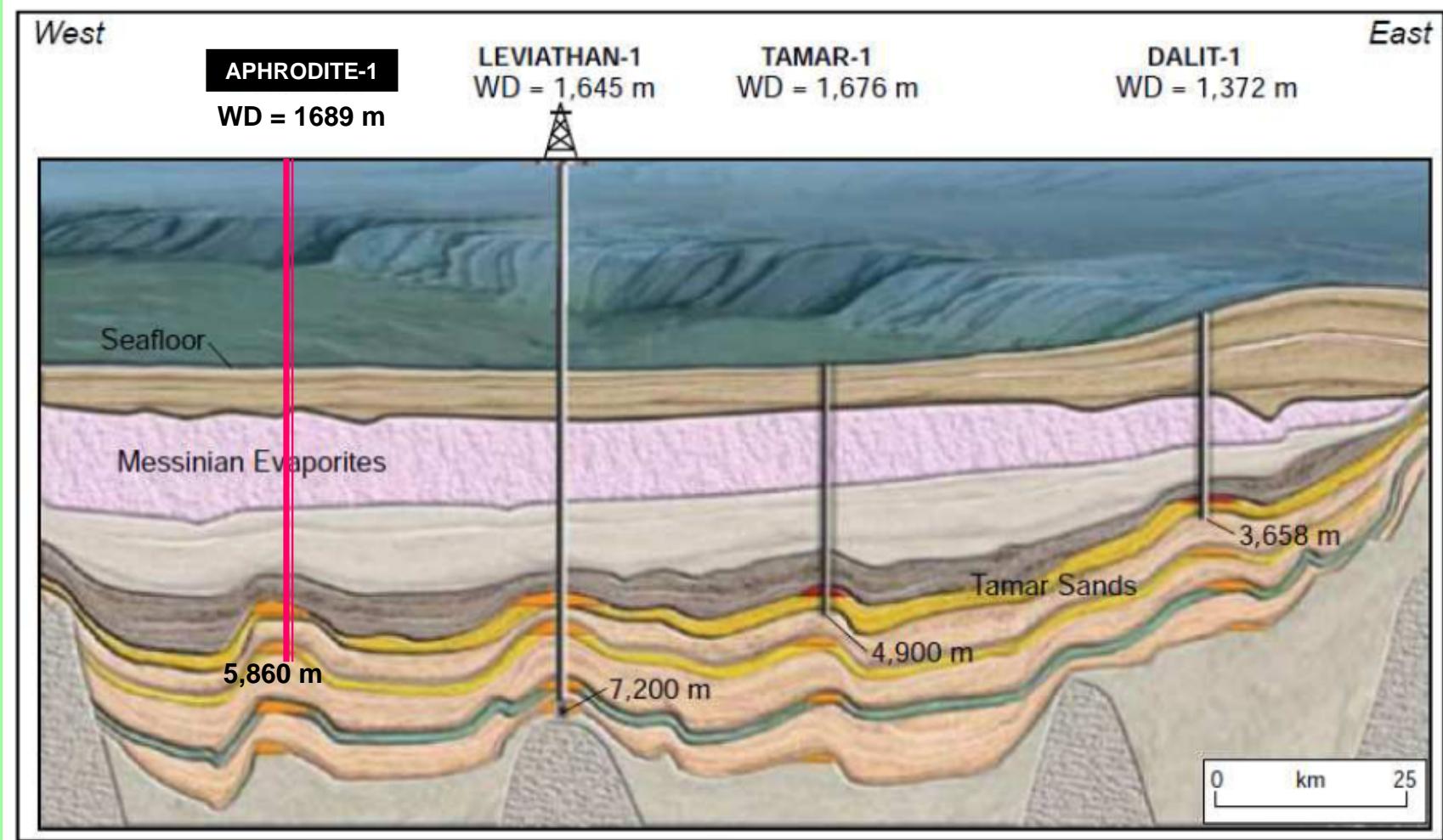


Offshore Cyprus basins & structures



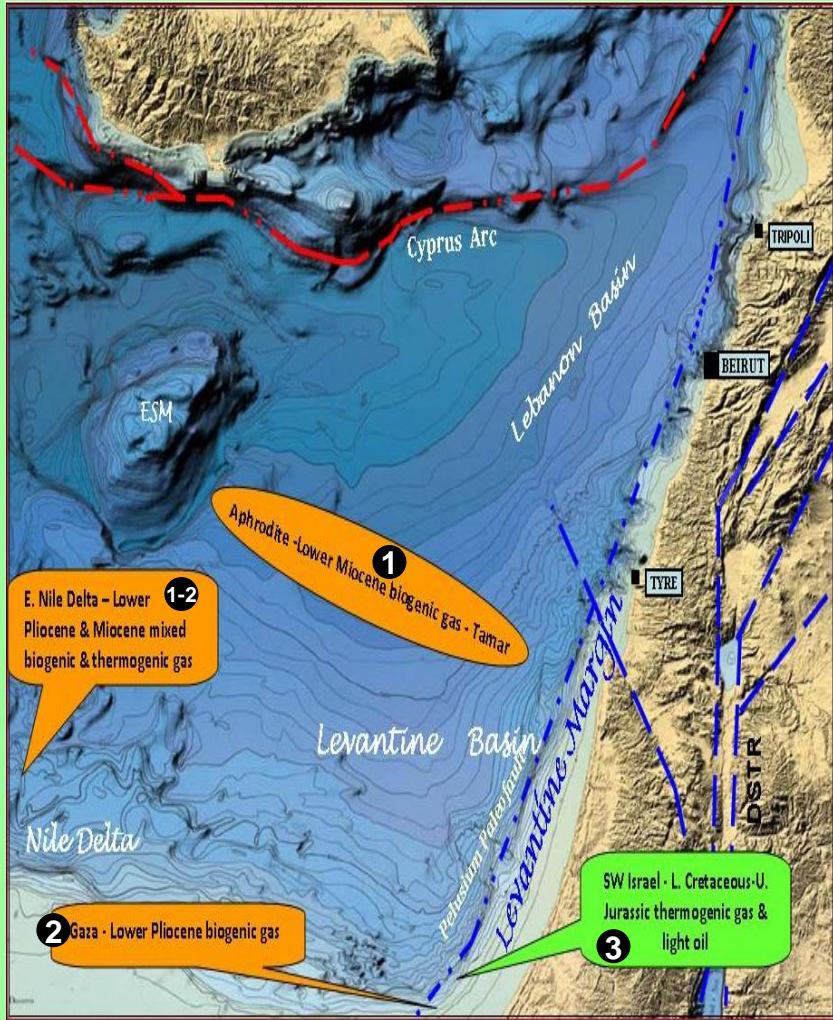


Lower Miocene biogenic gas discoveries





African plate basins hydrocarbon discoveries



Three proven regional hydrocarbon plays:

- **Play 1** – Sub-Salt Biogenic gas in Oligocene-Lower Miocene turbidite sands, Levantine Basin.

Primary exploration play of the Levantine Basin

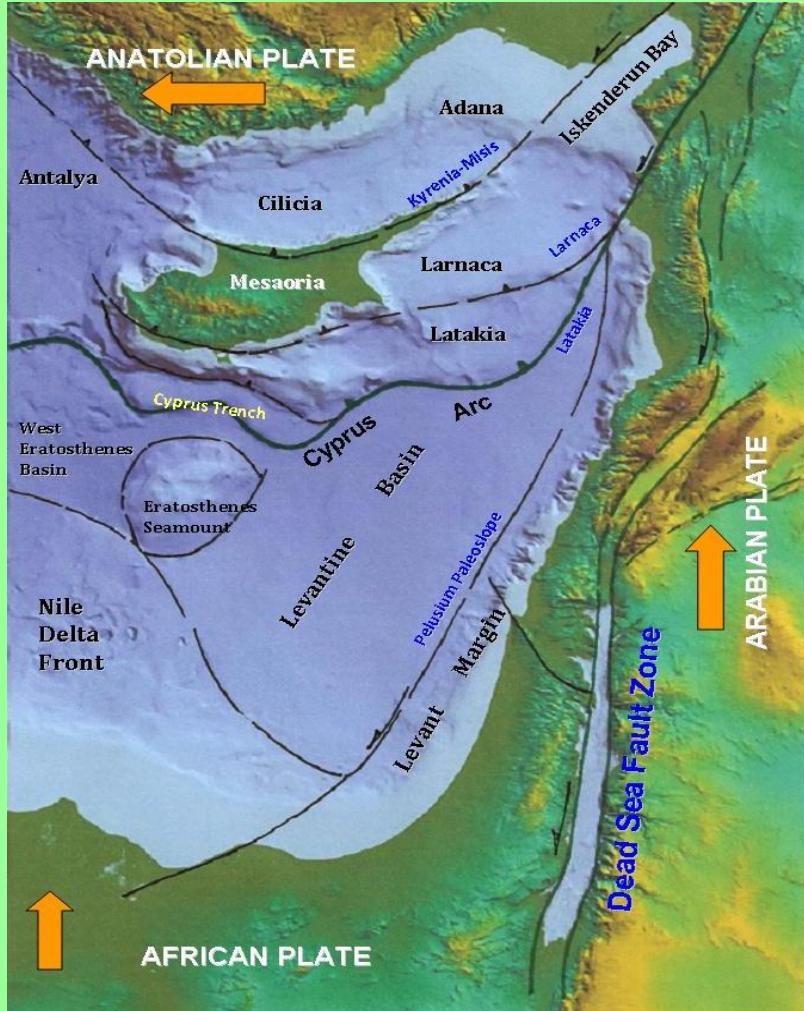
- **Play 2** – Post-Salt Biogenic gas in Lower Pliocene turbidite sands, Levant Margin.

- **Play 3** – Sub-Salt Thermogenic gas/light oil play in Lower Cretaceous sands and Jurassic limestones, Levant Margin.

Potential play in the Levantine Basin, in reservoirs associated with the Senonian unconformity or in deeper Mesozoic targets.



Anatolian plate basins hydrocarbon discoveries



Offshore Cyprus-NW Syria thrust area:

Basins of variable size with active subsidence since Middle Miocene along sub-parallel SW-NE/trending strike-fault systems.

- Iskenderun Bay:

Natural gas discoveries onshore in deltaic/marine sandstones of Middle-Upper Miocene age. Two small undeveloped oil discoveries present offshore.

- Adana: one producing oil field and two old, undeveloped gas discoveries.

Structurally complex basins with fair to good potential for Miocene and Messinian/Pliocene gas plays.

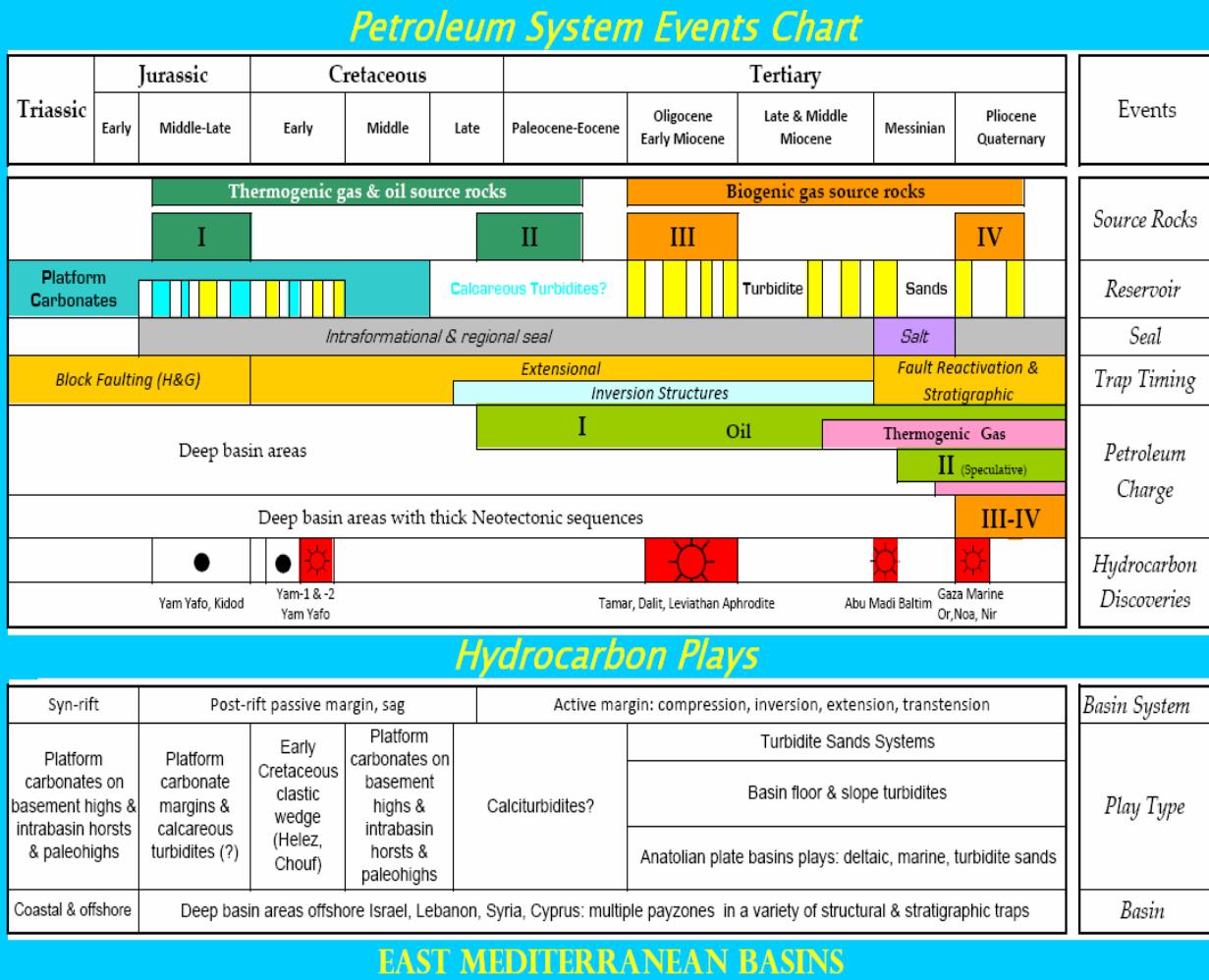


Hydrocarbon discoveries vs Geodynamics

GEODYNAMICS OF THE LEVANT PROVINCE & PETROLEUM SYSTEMS										Source		Reservoir	
AGE			PALAEOTECTONIC/PALAEOGEOGRAPHIC EVENTS										
	Qt	Tertiary											
Cretaceous	Pleistocene		Uplift of Southern Cyprus Pliocene faulting; slump deposits Intense Mio-Pliocene tectonics (Neotectonics) offshore						Channel, slope & distal fan turbidite sands	Neotectonics			
	Pliocene		Herodotus Salt basin						Low-stand & salinity crisis				
	Messinian		Syrian Arc II Folds - Palmyra fold & thrust belt Red Sea- Gulf of Suez Rifting						Oligocene-Lower Miocene turbidite sedimentation		Extensional Transpressive		
	Late Miocene		Dead Sea Rift System: sinistral wrench movements Oligocene Emergence						Oligocene Emergence				
	Middle Miocene		Uplift of Eratosthenes Seamount Syrian Arc I: Inversion Structures, folds & faults						Late Cretaceous-Eocene Flooding Event		Inversion		
	Early Miocene		Folding & RL transpression Obduction of Cyprus Syrian Arc I Folds						Transpressive (Israel) Extensional (Lebanon)		Closure		
	Oligocene		Plate convergence & collision: subduction of African plate underneath Eurasian plate						Plate Reorganisation				
	Eocene		Senonian Unconformity Sea-level highstand, maximum flooding						Passive margin				
	Paleocene		Intense extensional faulting: Albian Aptian Uplift & erosion						Spreading				
	Maastrichtian		Neocomian rifting Global sea level drop						Vertical Extensional				
Jurassic	Campanian-Santonian		End Jurassic: Uplift & erosion Jurassic Rifting: Block Faulting, Horsts & Grabens						Jurassic Platform Differentiation	Rifting			
	Coniacian								Triassic-Liassic dominant carbonate platform sedimentation				
	Turonian												
	Cenomanian												
Triassic	Albian												
	Aptian												
	Barremian												
Jurassic	Neocomian												
	Malm												
	Dogger												
Jurassic	Lias												
			Triassic basins of Syria, Lebanon, Jordan & Israel										



Petroleum Systems - East Mediterranean Basins



Four main Petroleum Systems identified to date.

* **Biogenic gas source rocks:**

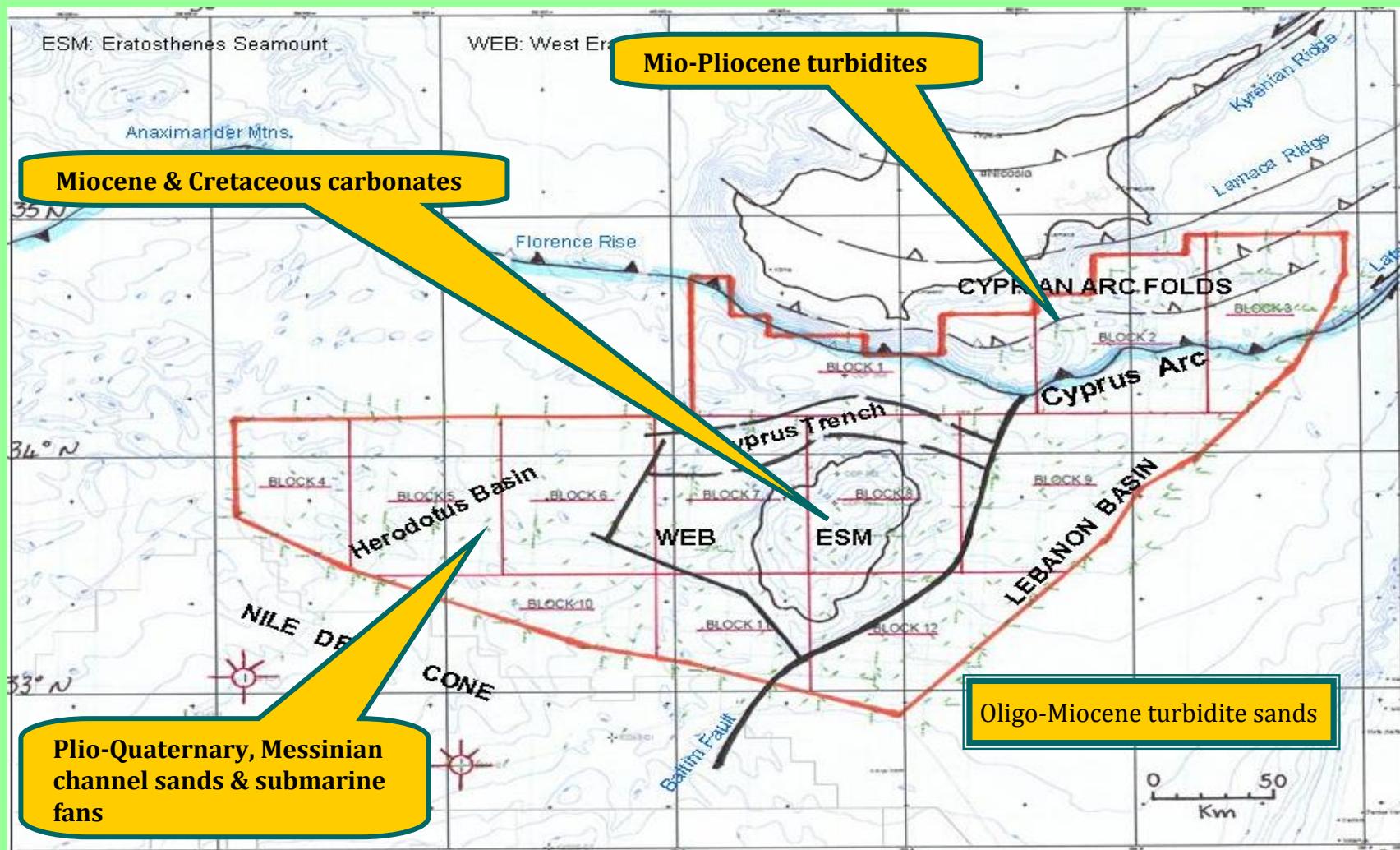
- Plio-Quaternary clays (IV)
- Oligocene-Lower Miocene shales & clays (III)

* **Thermogenic gas & oil source rocks:**

- Senonian-Eocene marls & limestones (II)
- Mid-Upper Jurassic shales & carbonates (I)



Offshore Cyprus plays





Conclusions

Offshore Cyprus straddles the tectonic boundary between two tectonic plates, with basins displaying different stratigraphic and structural histories.

As a result, varied and diverse basin-specific exploration plays are present.

As proven by the Aphrodite-1 well discovery, the Lower Miocene biogenic gas play (the primary play in the Levantine basin) occurs offshore Cyprus, to the south-east of the island (Block 12).

Additional exploration opportunities are expected in:

- **Miocene-Cretaceous carbonates associated with the Eratosthenes Seamount;**
- **Oligocene-Miocene turbidite sands of the West Eratosthenes basin;**
- **Messinian & Plio-Quaternary channel sands and turbidite fans in the Herodotus basin;**
- **Middle Miocene to Pliocene marine sands in basins to the east associated with the Cyprian Arc folds.**



THANK YOU!



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