



## **TUNISIA EXPLORATION OPPORTUNITIES**

**IMAGE#23, Houston, TEXAS**

**28 August-1 September 2023**

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**Geologist, Promotion Deputy Manager**

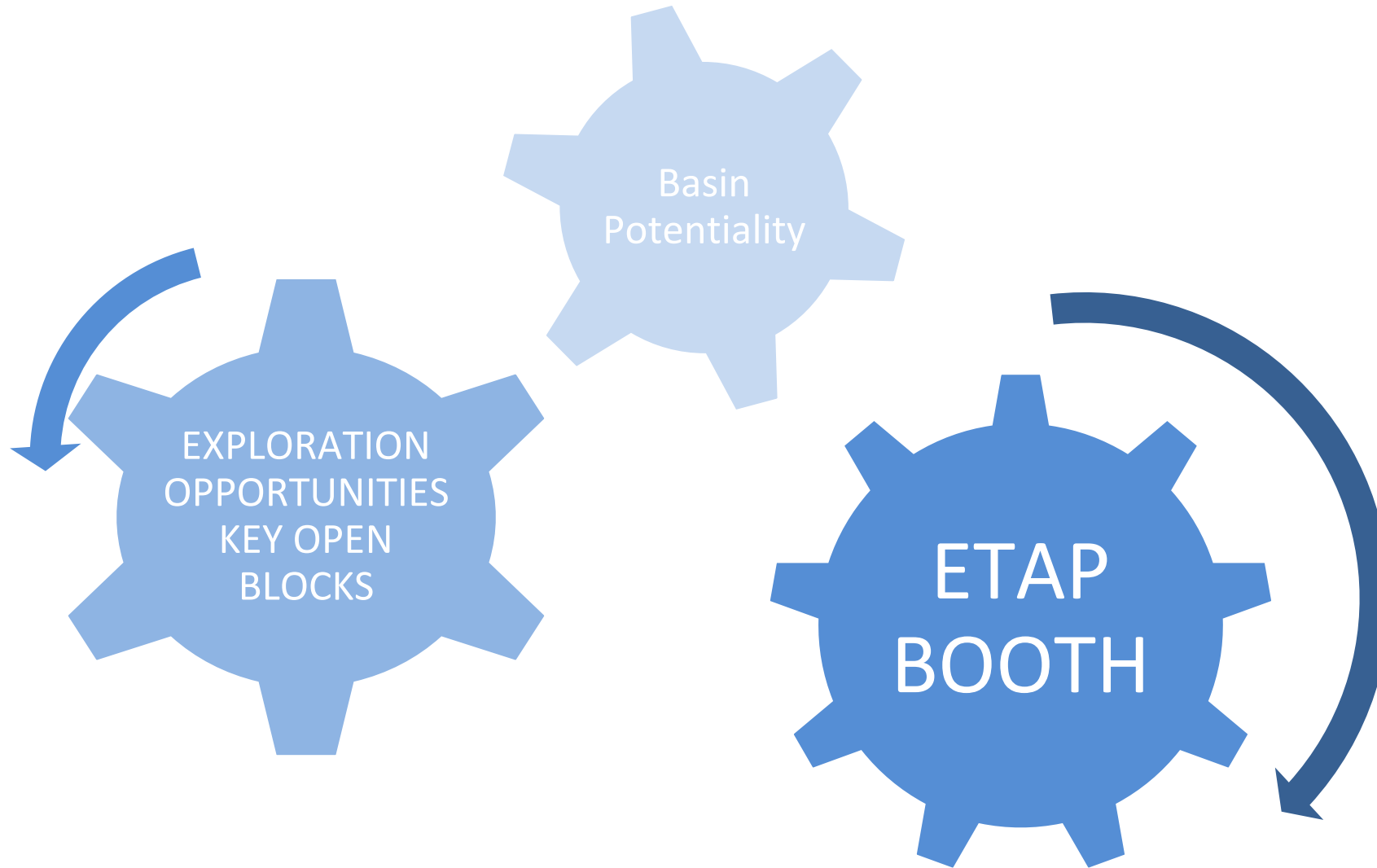
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1- Tunisia Current Situation

2- Tunisia Proven Basins Potentiality

Ghadames Mature Basin Opportunities

Pelagian Emerging Basin Opportunities

3- Challenges & Opportunities in Frontier Basin

4- Other Exploration Opportunities

5- Conclusion



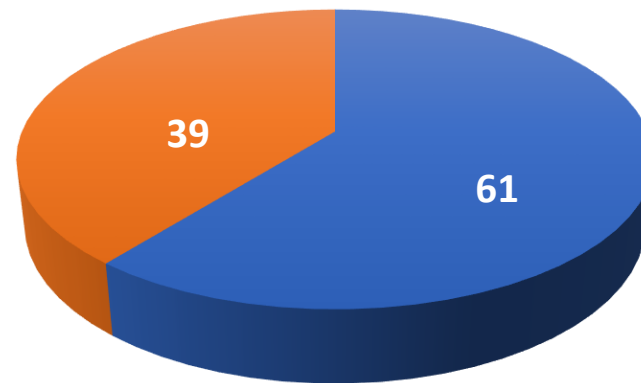
The Tunisian territory extends over: 255 087 km<sup>2</sup>



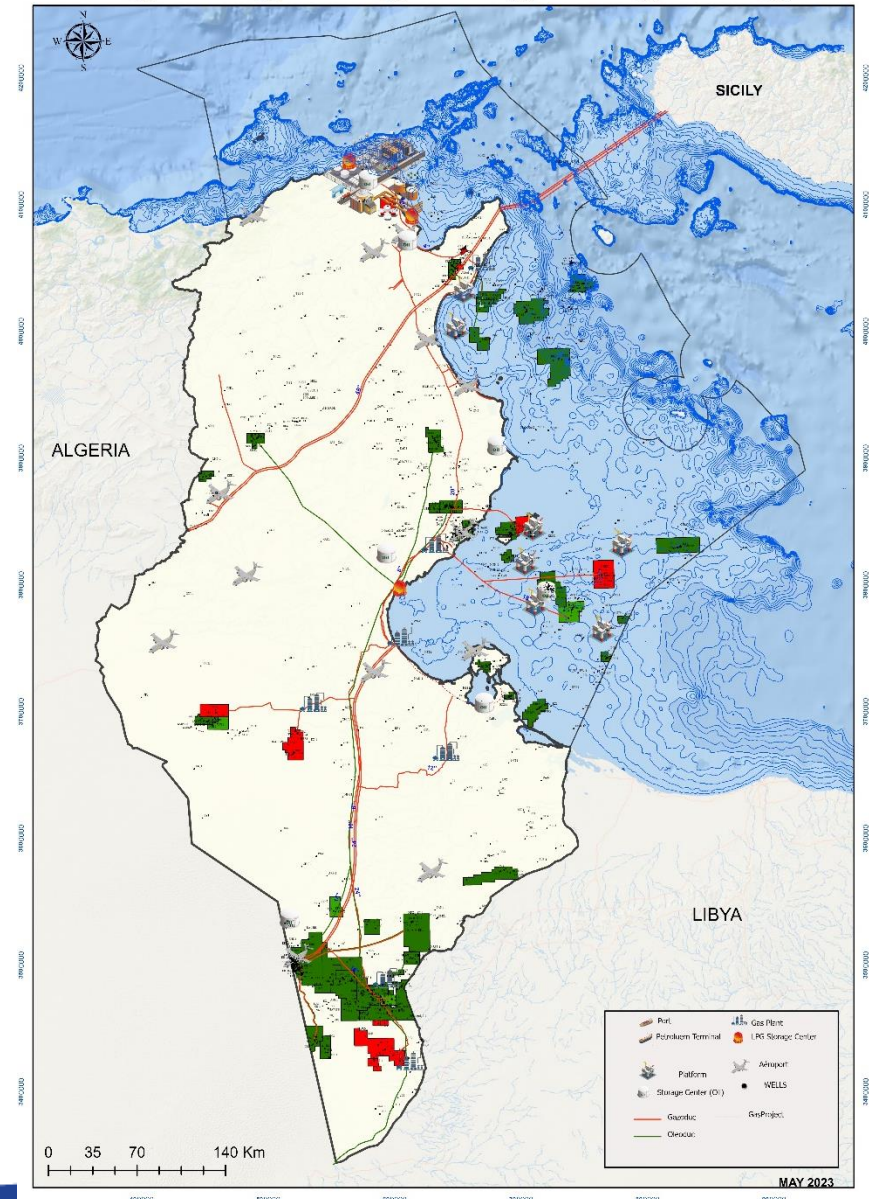
TUNISIA

Area of the mining domain

- 61 % Onshore
- 39% Offshore



■ Onshore area ■ Offshore area





Number of drilled wells = 1100



- **Area 1/ North Onshore area**

1909 Surface geology , surface seeps

- **Area 2/ the Cap Bon & north-central**

1945 Surface geology , 2D Seismic

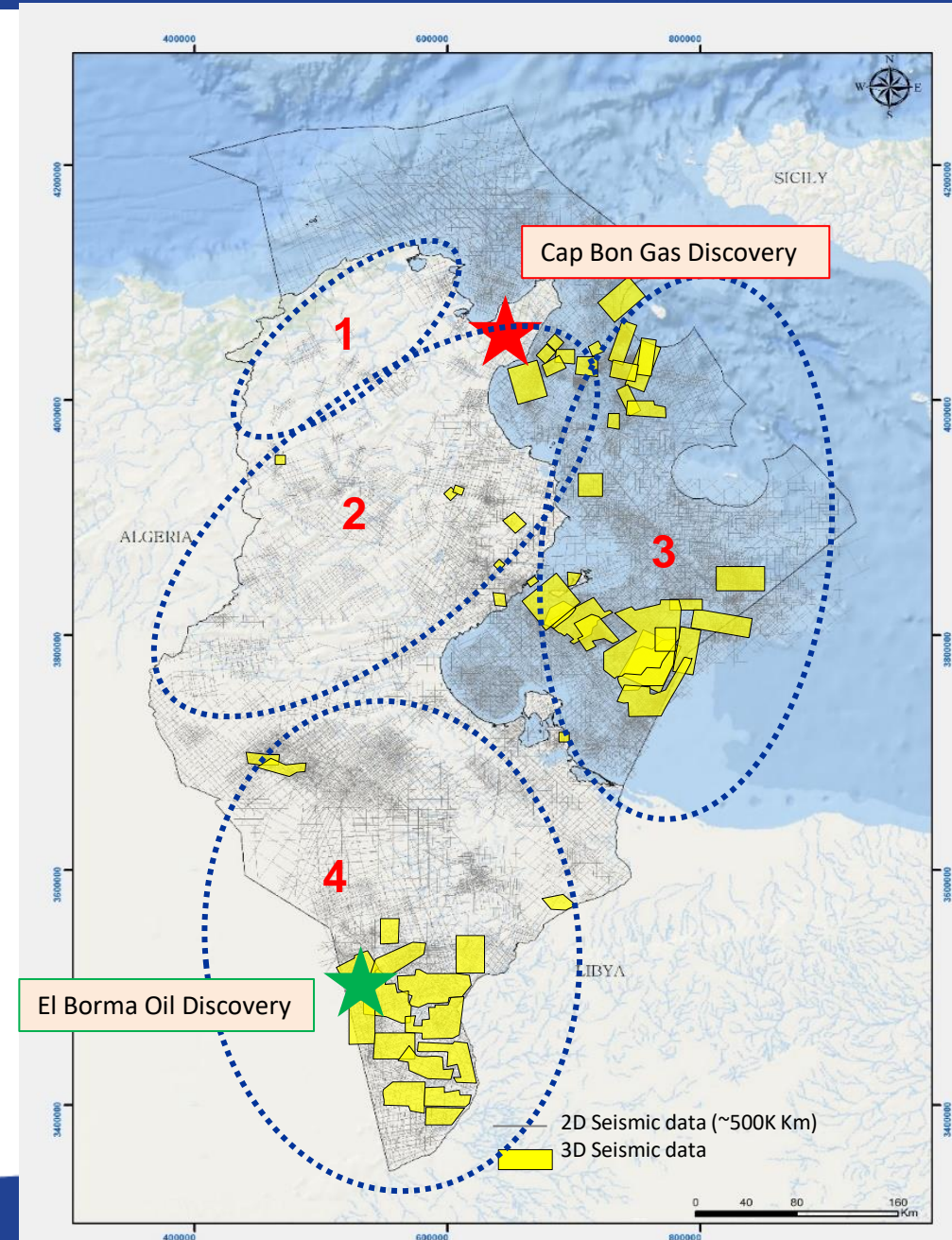
- **Area 3/ Eastern offshore Tunisia**

1950 Started the exploration of Eastern offshore Tunisia

- **Area 4/ Southern Tunisia**

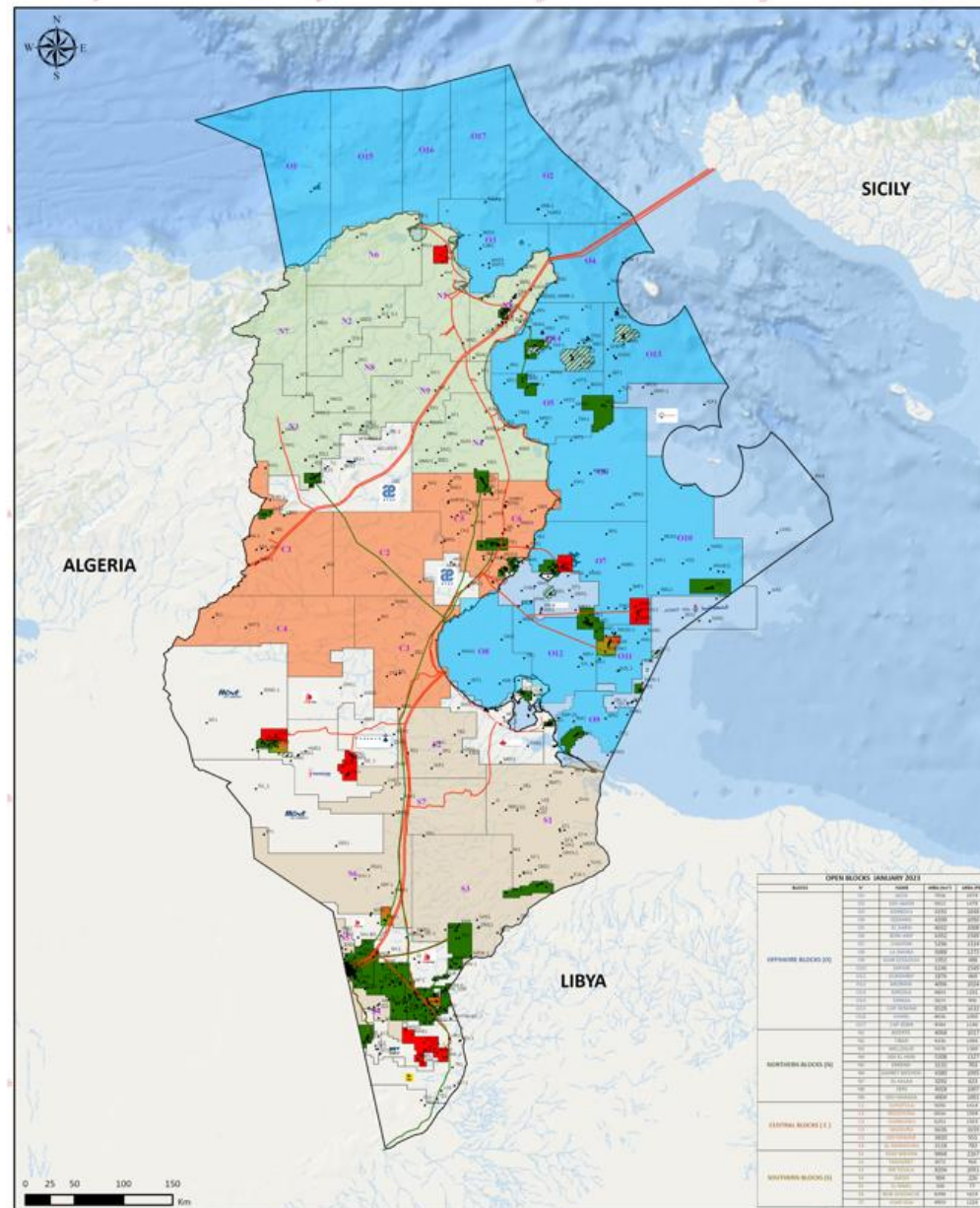
1956 Started the exploration of Southern Tunisia

(El Borma giant oil Discovery 1964)

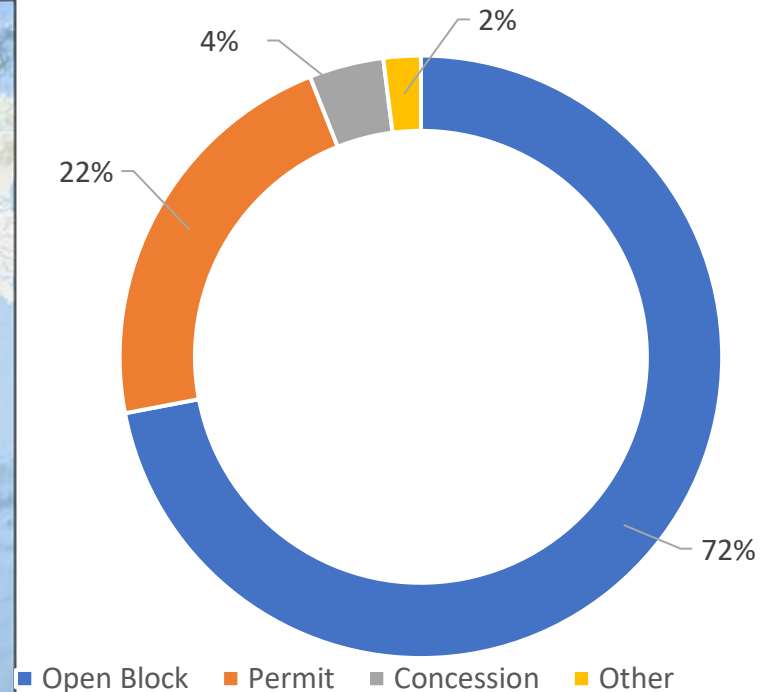


# Tunisia Current Situation\_Hydrocarbon Titles Map

## Main Upstream Operator in Tunisia



OFFSHORE OPEN BLOCKS	SOUTHERN OPEN BLOCKS	PRODUCTION OIL & GAS LICENCE	UNDEVELOPED OIL LICENCE	GAS PROJECTS
NORTHERN OPEN BLOCKS	HYDROCARBON TITLES	UNDEVELOPED GAS LICENCE	PRODUCTION OIL LICENCE	GAS PIPELINES
CENTRAL OPEN BLOCKS	PRODUCTION GAS LICENCE	WELLS	OIL PIPELINES	



56 Oil and Gas production licences

17 Exploration licences ( 14+3)

39 Open Block



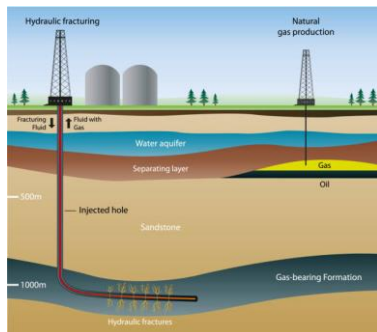
## Conventional Proven Reserves:

- > 1.9 BBLO      **Oil Recovery Factor : 24%**
- > 5.5 TCFG      **Gas Recovery Factor : 27%**



## Estimated remaining conventional resources:

- > 1 BBLO
- > 7 TCFG



## Estimated technically recoverable unconventional resources ★

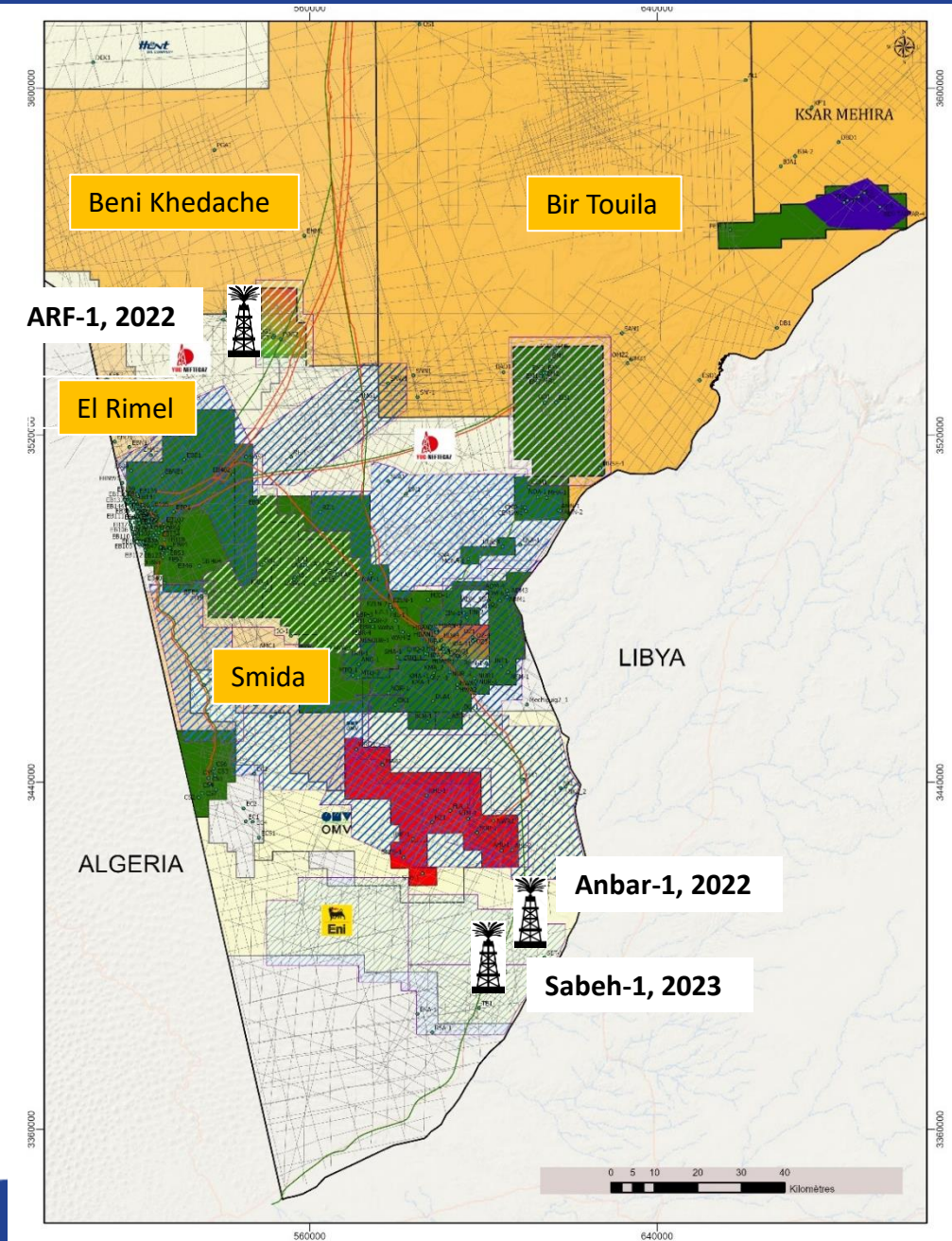
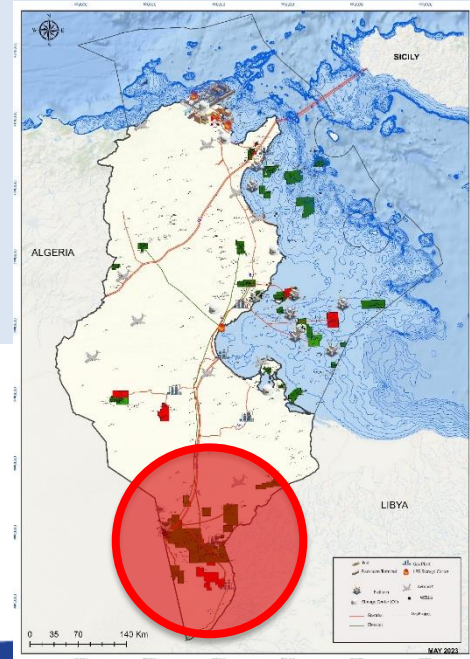
- 1.5 BBLO
- 23 TCFG



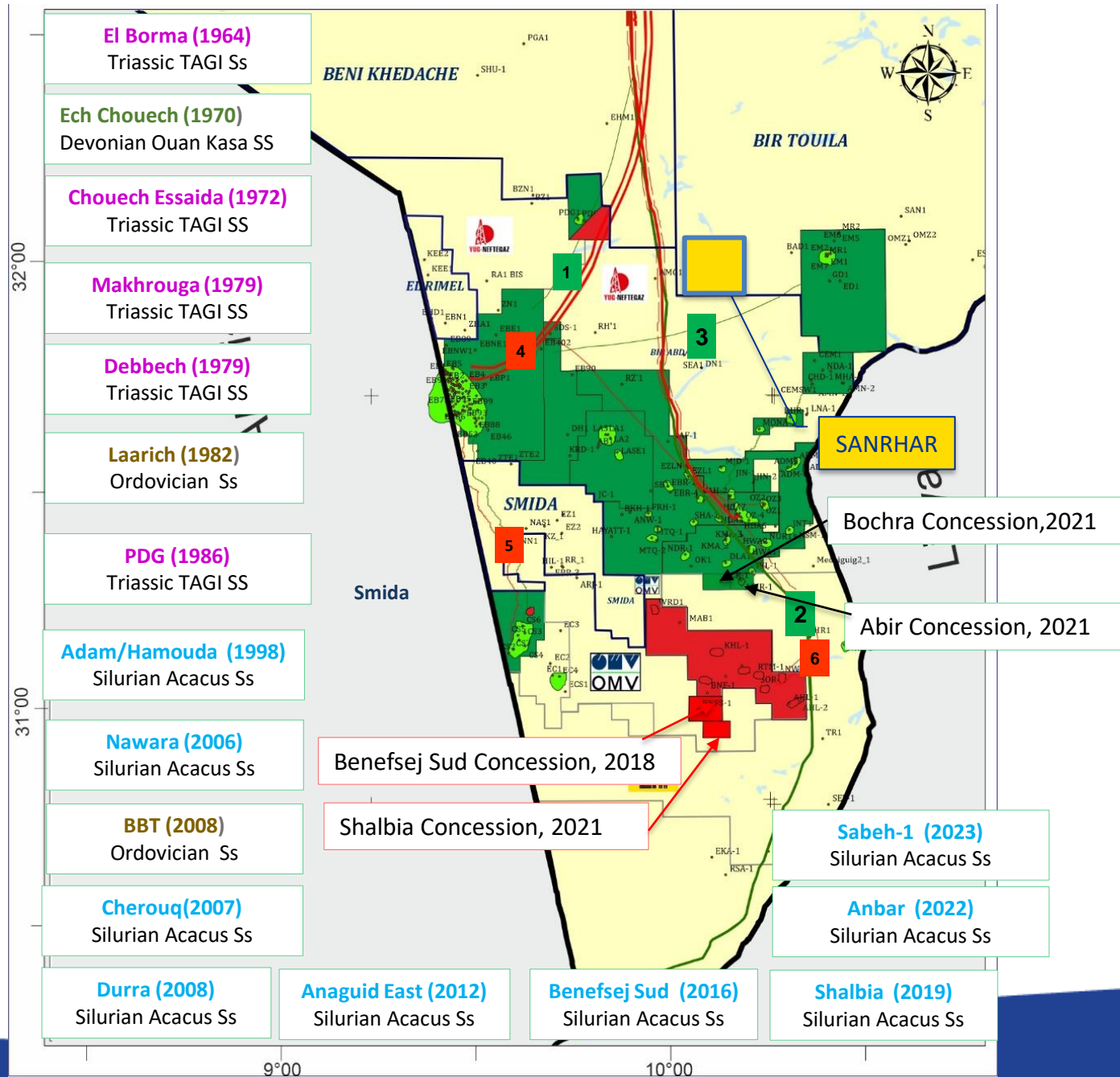
# Ghadames Basin Opportunities



- 296 Wells (24 % Exploration, 76% Production)
- Seismic: 2D & 3D ( 40%)
- 17 Production Fields (4 recently discovered 2018-2022)
- 4 Permits (YNG, ENI, OMV)
- 3 New Discoveries ( ARF-1, Anbar-1, Sabeh-1)
- 4 Open blocks
  - Smida (904 Sq Km)
  - El Rimel (308 SqKm)
  - Beni Khedache (6496 Sq Km)
  - Bir Touila ( 8204 Sq Km)













## Oil & Gas Pipelines

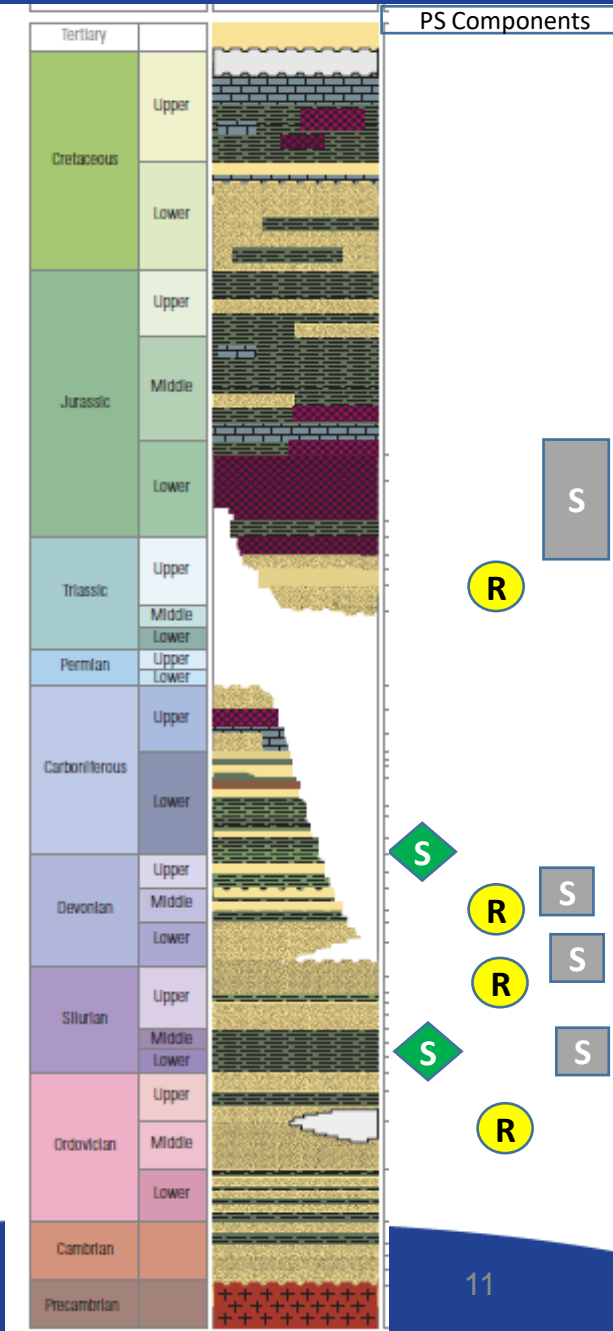
- Oil pipeline El Borma-La Skhira
- Oil pipeline D'In Amenas
- Oil pipeline Makhrouga-El Borma
- Gas pipeline El Borma-Skhira (Gasoduc Souterrain)
- Oil/Gas pipeline Chouech Essaida-El Borma
- Gas pipeline Nawara-Ghannouch, 1370Km, 24 inch

## Main Undeveloped Opportunities

- **SANRHAR**, depleted field
  - discovered 1989 Triassic TAGi Channel SS
  - OOIP 14.1 MMstb
  - Cumulative Production ( 2017) 470 Mstb



PS	Units	Parameters
 Sources	Silurian Tannezuft Hot Shale	TOC: 10-20% Kerogene type II
	Devonian Aouinet Aouinine Hot Shale	TOC: 2-15% Kerogene Type II
 Reservoirs	Middle Triassic TAGI	Fluvial sandstone Ø = up to 27% K = up to 1500 mD
	 Triassic Salt	
	Upper Silurian Acacus	Sandy delta front bars Ø = up to 24% K = up to 600 mD
	 Intraformational Shale	
	Early Devonian	Fluvial to shallow marine SS Ø = up to 22% K = up to 200 mD
 Upper Devonian		
 Lower Silurian Shales	Ordovician Jeffara/ KL/Bir Ben Tartar	Glacial /to periglacial SS Ø = up to % K less to 1 mD



## 1-Structural traps

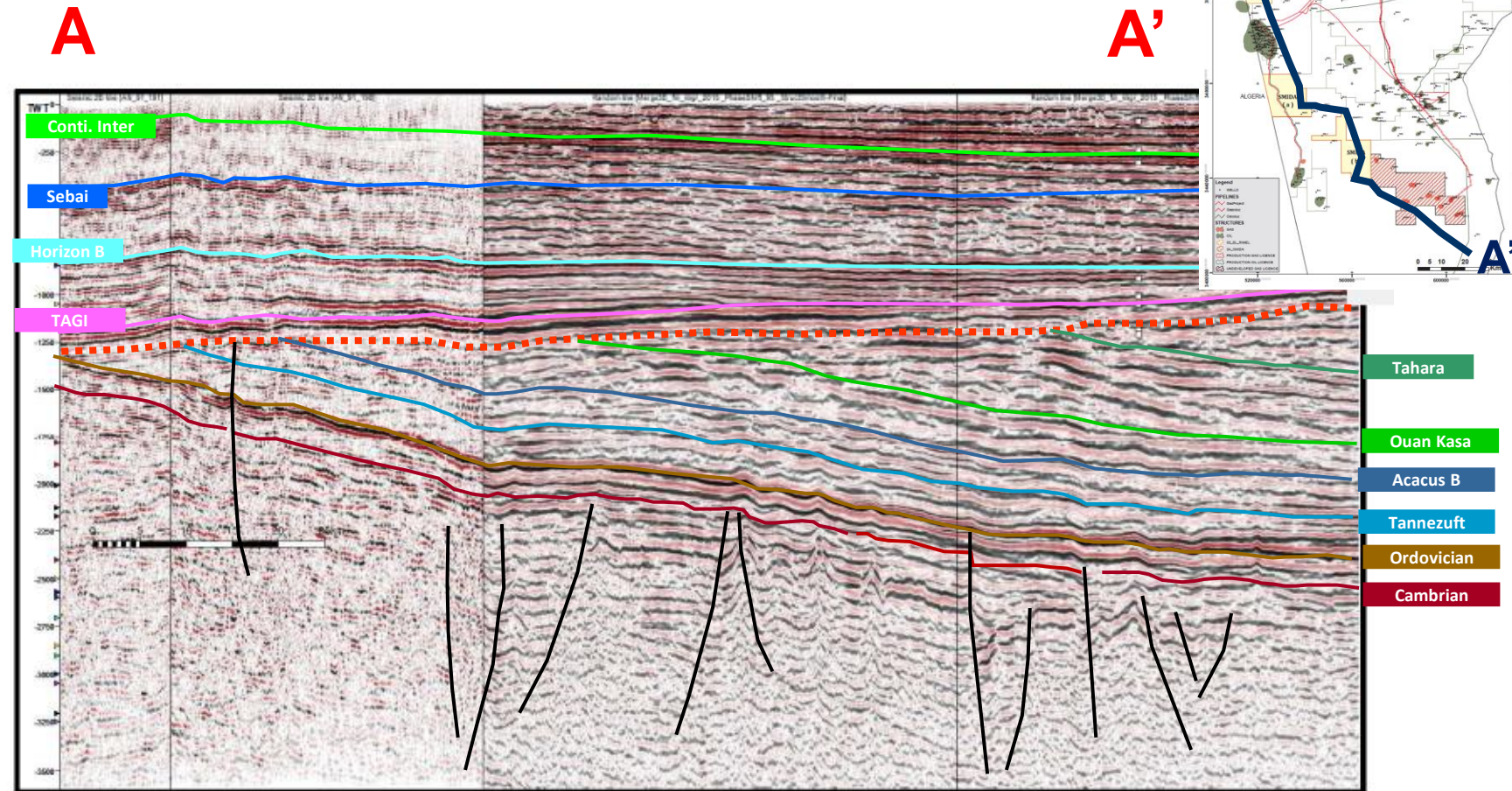
- Pre-Hercynian Simple anticline
- Normal faulted structures
- Reverse faulted structures

## 2- Stratigraphic traps

- Unconformity ( Hercynian)
- subcrop and pinchout of paleozoic reservoirs below HU
- Channel fill with the TAGI

## 3- Combined

## Stratigraphic/Strutural Trap

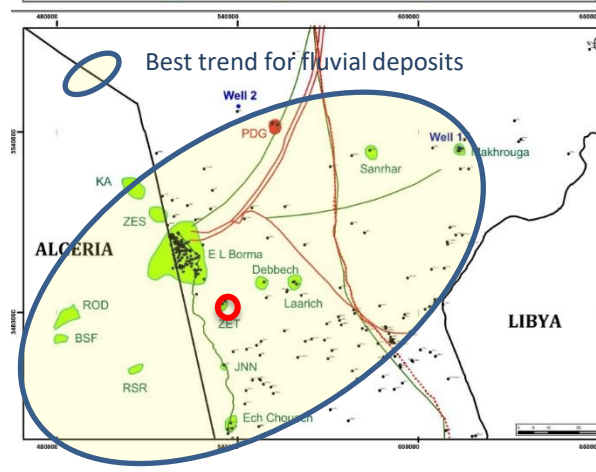
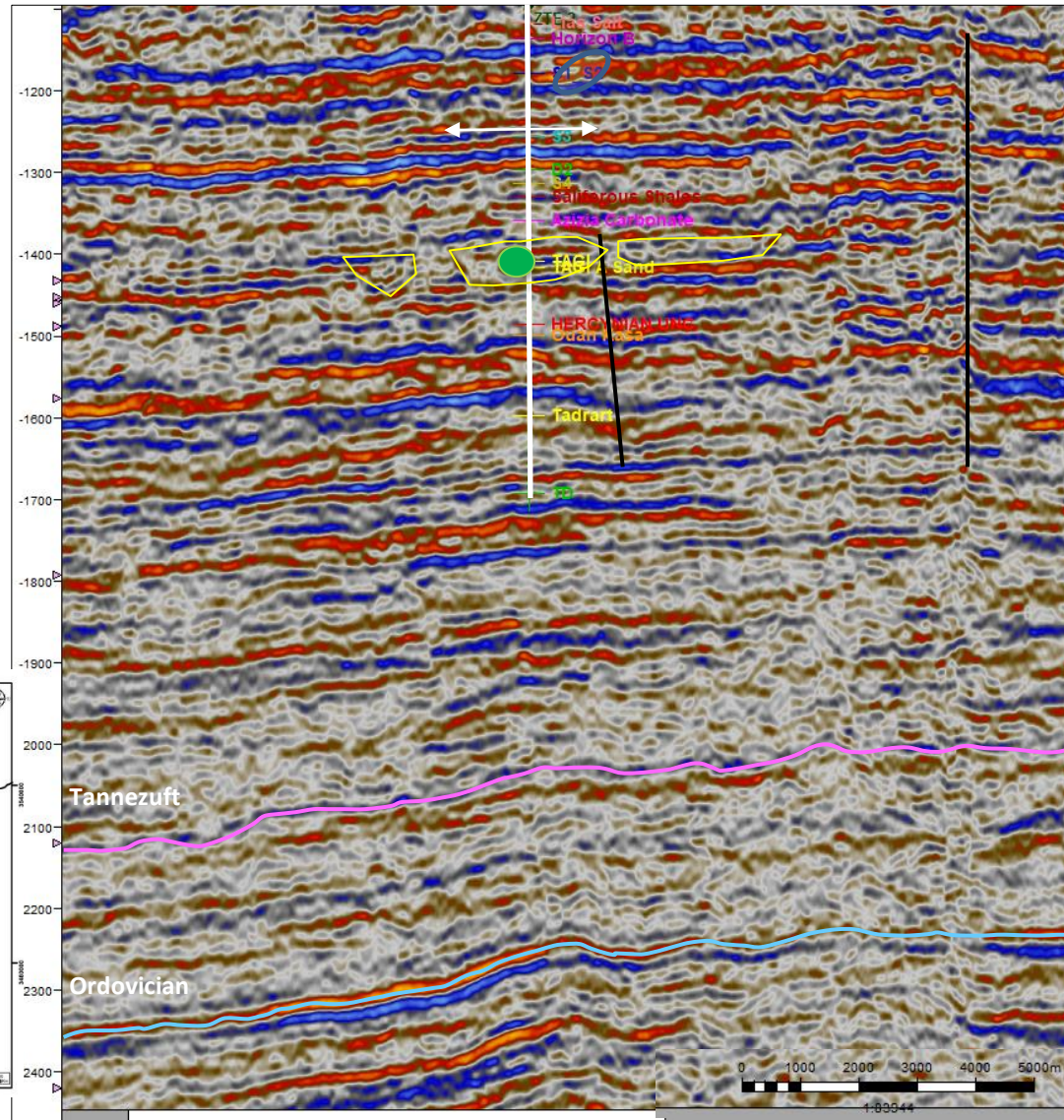
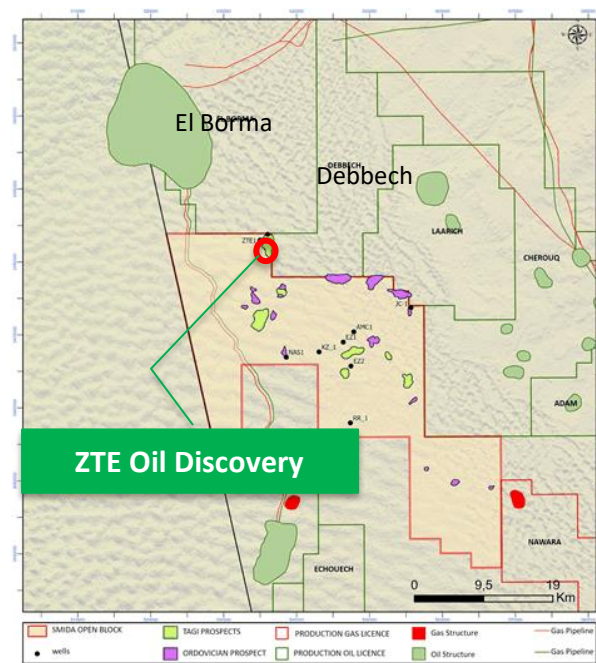




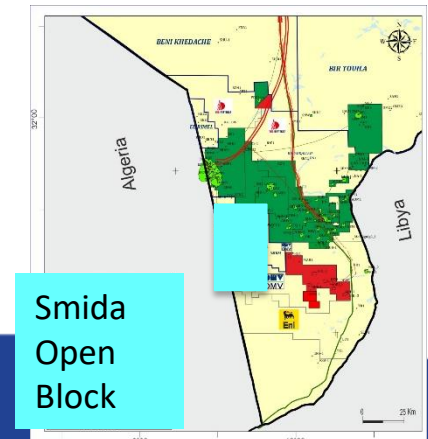
# Tunisia Ghadames Basin\_Smida Open Block Opportunity

## ZTE Triassic Fluvial sand Discovery

ZTE-2 Tested 750 BOPD 41° API



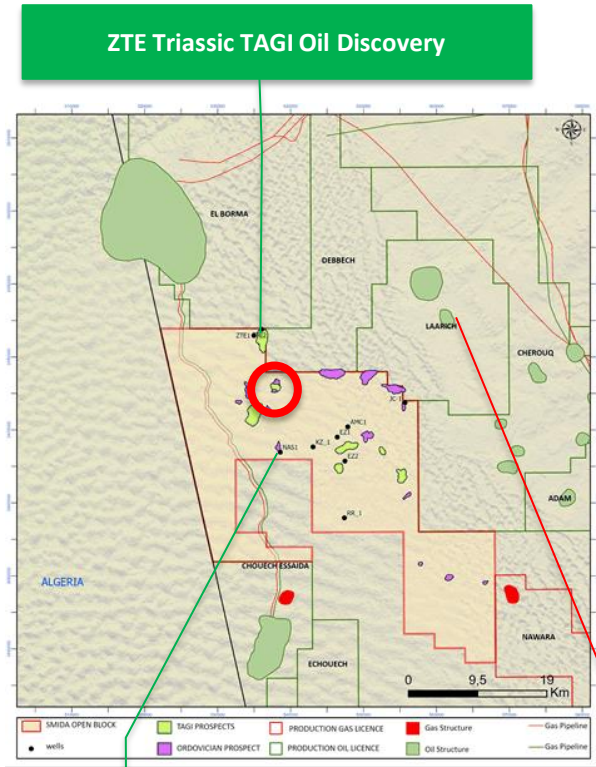
- Adjacent to El Borma Giant El Borma field (more than OIIP = 1600 MMbbls & Debbech field ( more than OIIP = 100 MMbbls)
- 8Km far Oil/Gas pipeline Chouech Essaida-El Borma (6")
- TAGI sandstone primary objective proven towards the North & the South Fields
- high potential for the development of stratigraphic traps Fluvial depositional environments of Triassic TAGI Level
- 3D seismic defined structure
- Promising for the Deep reservoirs ( Silurian & Ordovician



Smida  
 Open  
 Block



## Ain Dhiab Multi proven Targets

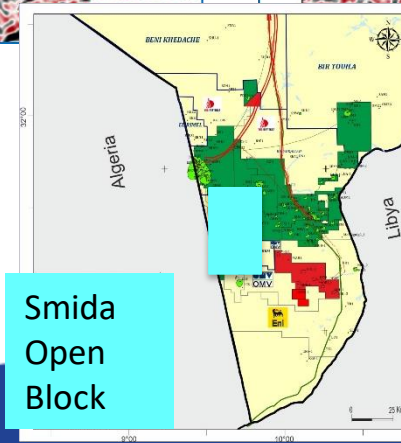
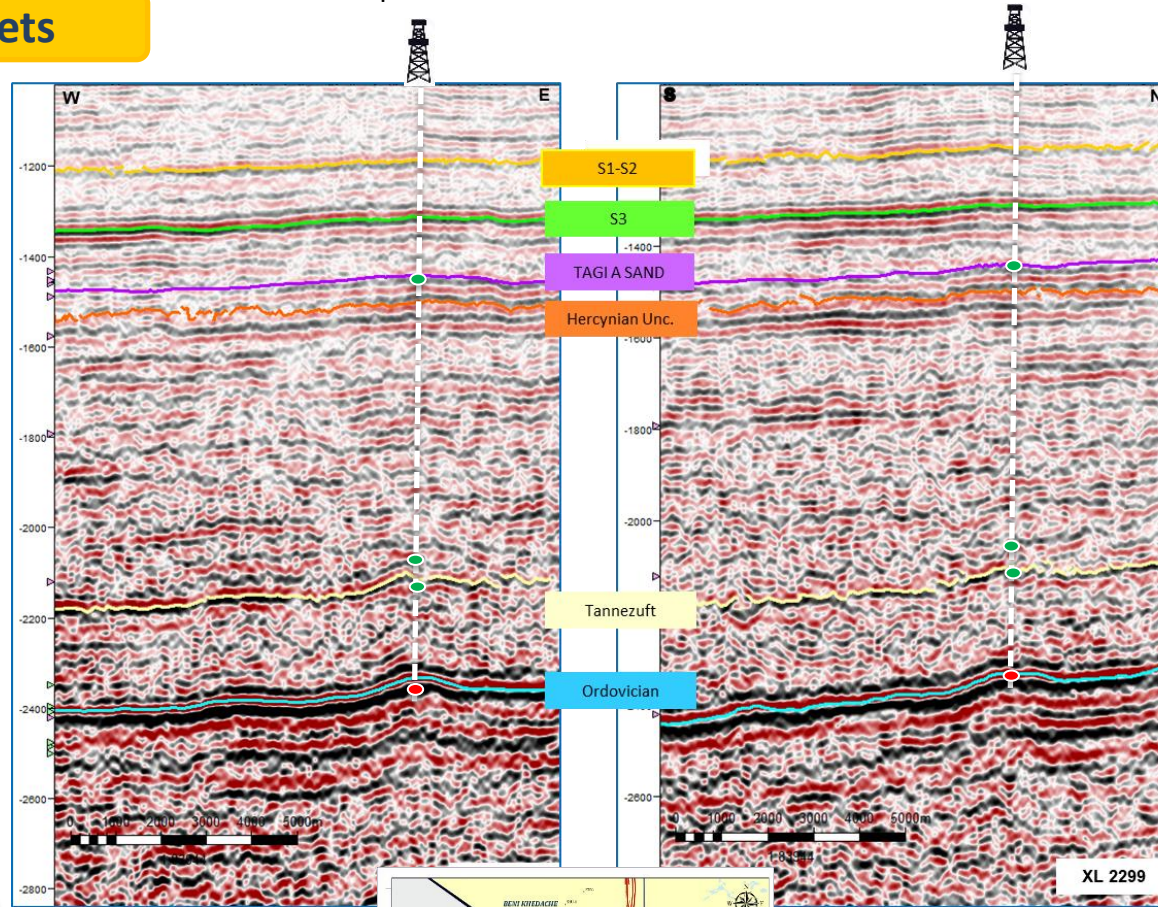


ZTE Triassic TAGI Oil Discovery

NAS Silurian Oil Discovery

Laarich Ordovician Gas & Condensate Discovery

Proposed Well

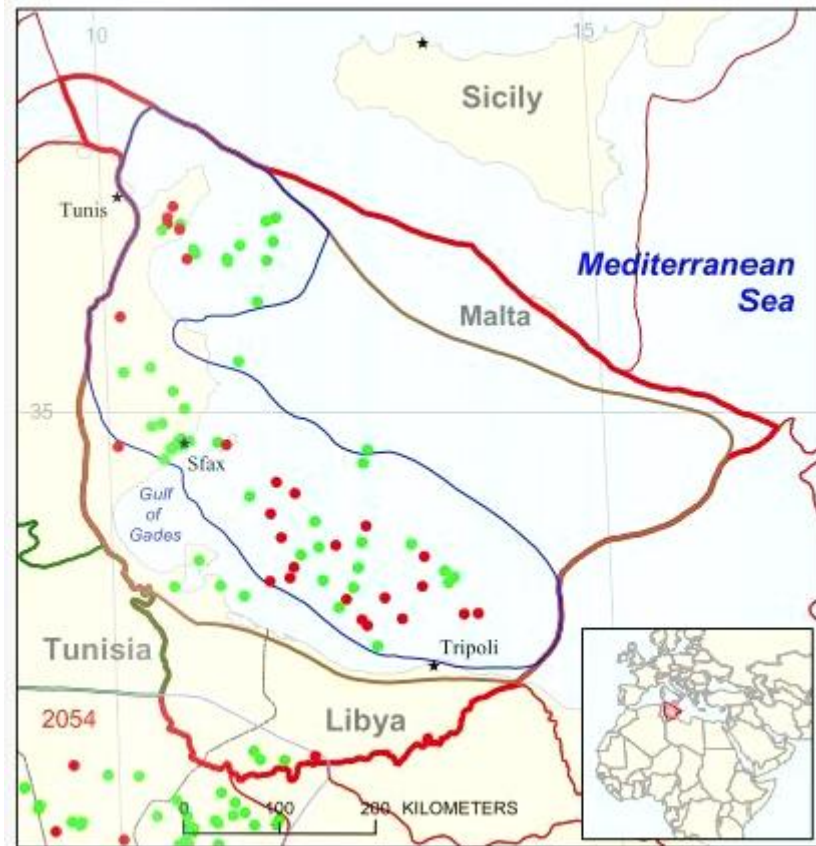


Smida Open Block

- **Muti Objectives** : Triassic TAGI SS  
 Silurian Acacus A / Upper Tnzst Sand  
 Ordovician Sandstones
- **Structure** : 4-way-dip closure, well defined by fair quality 3D seismic
- **Reference Wells**:  
 ZTE-2 (~5Km) discovery oil at Triassic TAGI  
 NAS-1 ~8Km discovery oil at Upper Silurian reservoir,  
 LA-2 ~24Km discovery gas&condensat at Ordovician
- **Est .Resources** :  
 TAGI 10MMBO (Pmean In-Place)  
 Acacus /TNZT 8MMBO (Pmean In-Place)  
 Ordovician 9 BCF (Pmean In-Place)
- **Estimated POS 21%**
- **8Km far Oil/Gas pipeline Chouech Essaida-El Borma (6'')**

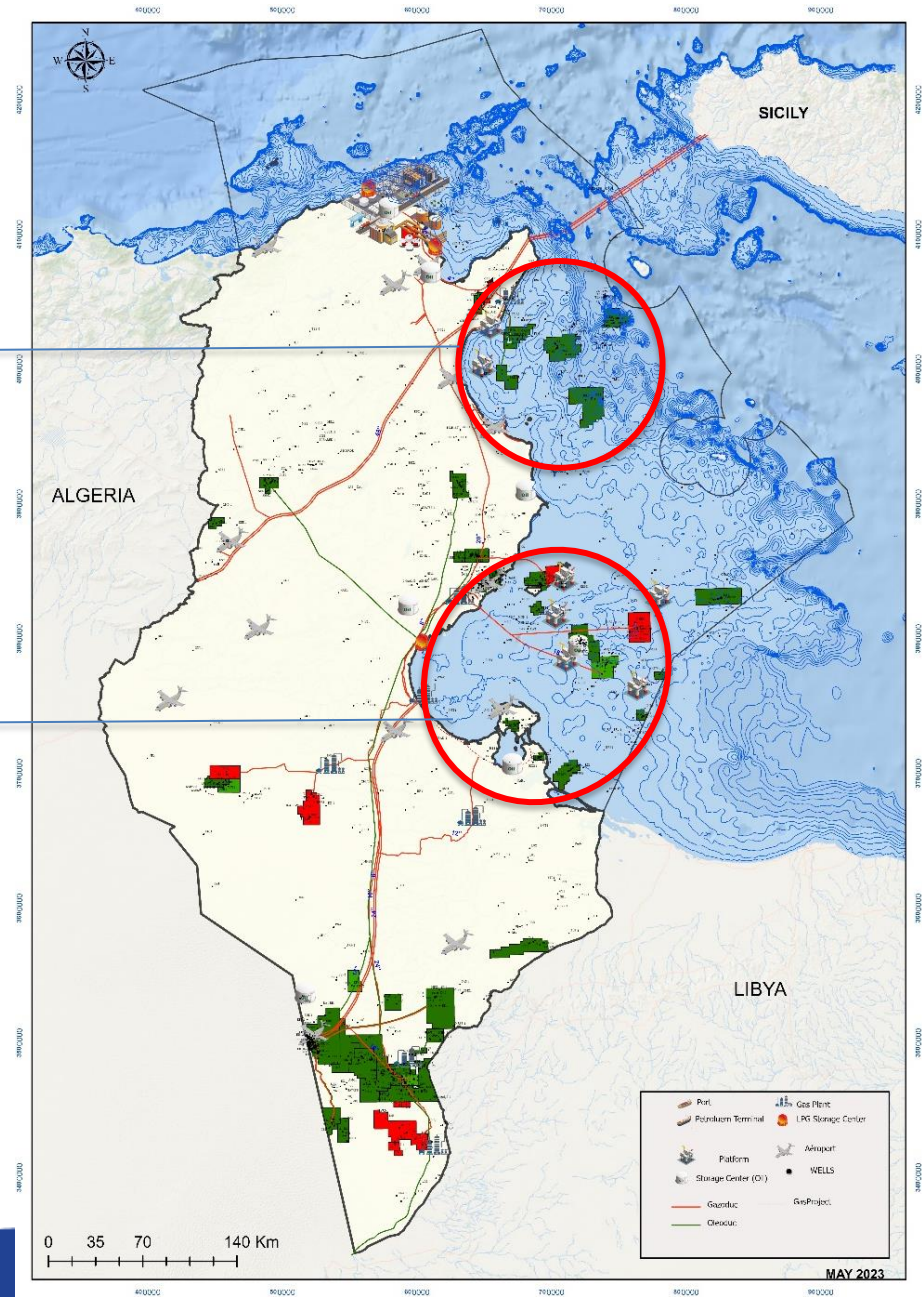


# Pelagian Emergin Basin



Gulf of Hammamet

Gulf of Gades



Recoverable discovered reserves (USGS, 2000) 8500 MMBOE

**1755 MMBOE** In Tunisia



# Gulf Of Gabes Exploration Opportunities





- Water Depth 0- 100m
- **215 Wells** (37 % Exploration, 63% Production)
- **Seismic: 60, 000 Km 2D & 6,200 SqKm 3D (31%)**
- 10 Production Fields
- 2 undeveloped oil fields (Zarat & Ras El Besh))
- 3 Permits (PANORO, Joint Oil, EATP)
- 6 Open blocks

Oudhref (1876 Sq Km)

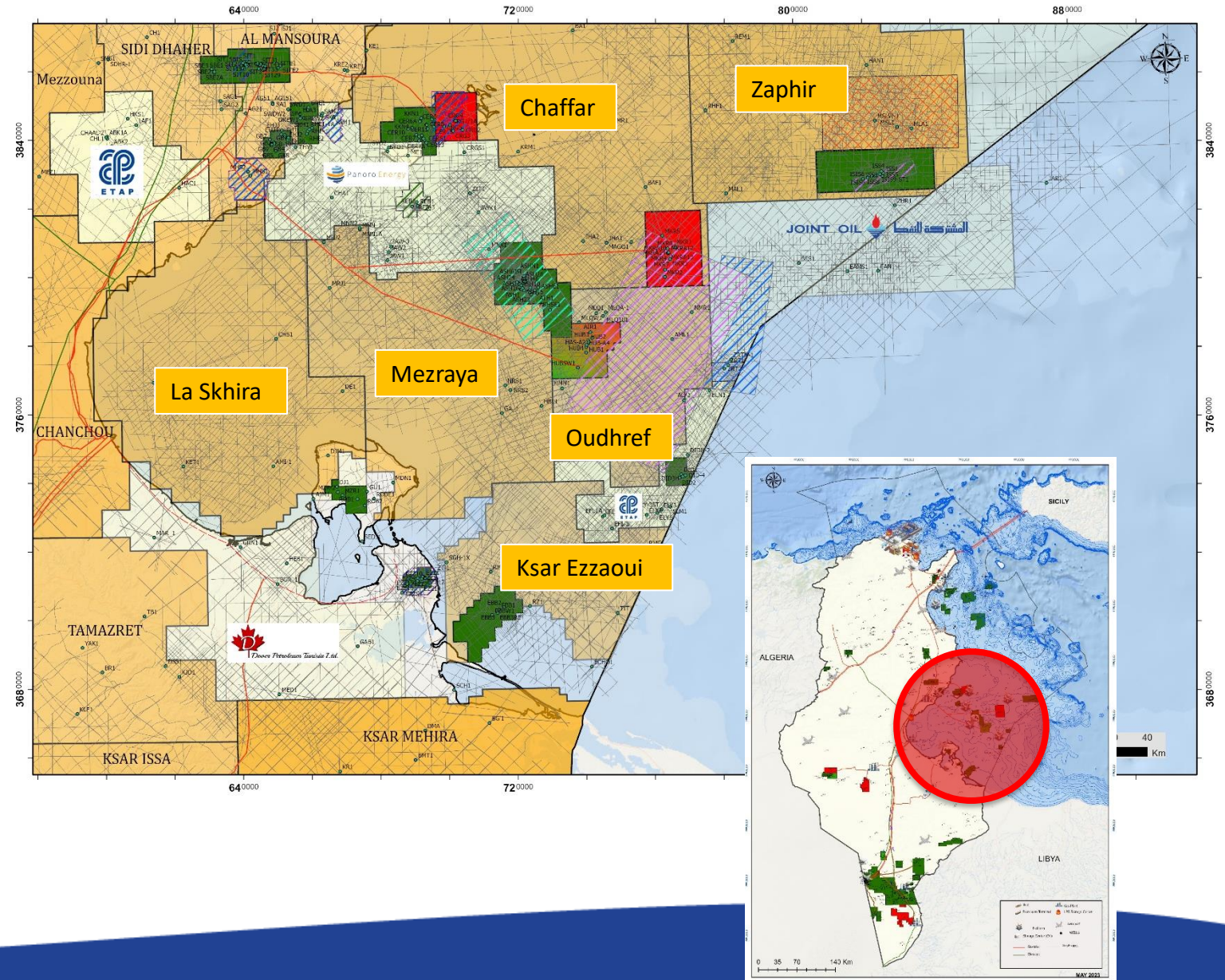
Chaffar( 5296 SqKm)

Zaphir (6196 Sq Km)

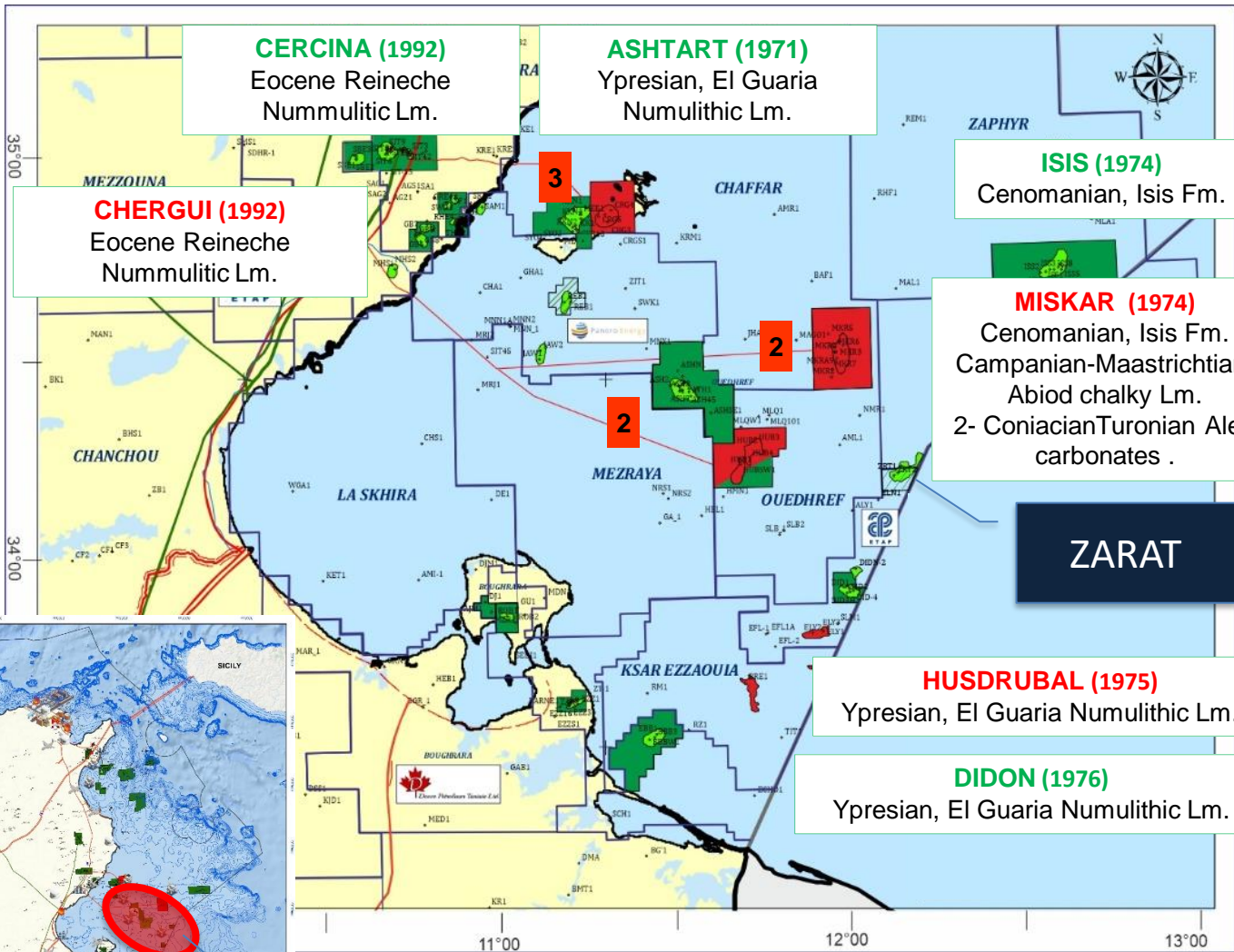
La Skhira (5088 Sq Km)

Ksar Ezzaoui ( 1952 Sq Km)

Mezraya (4804 SqKm)







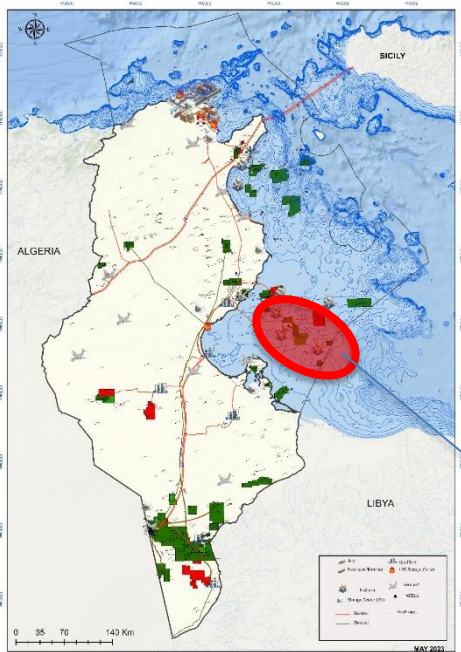
## Oil & Gas Pipelines







- 1 Gas pipeline Miskar-Sfax 125Km of 24 inch
- 2 Gas pipeline Hasdrubal-Sfax 109Km of 18 inch
- 3 Gas pipeline Chergui-Sfax, 50Km of 6 inch

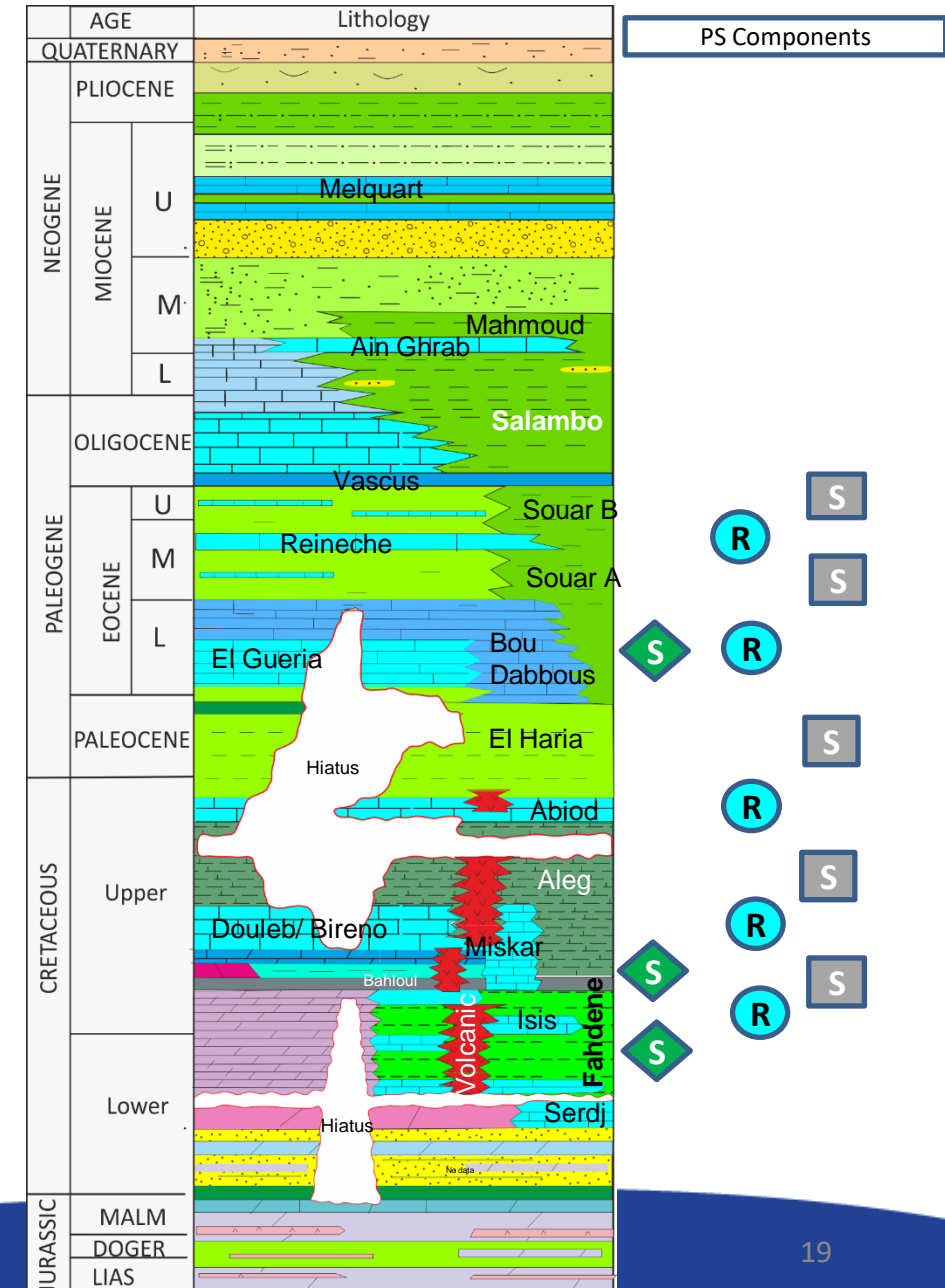
## Main Undeveloped Opportunity = ZARAT

- ZARAT Opportunities discovered 1992 Ypresian, El Guaria Numulithic Lm.
- 390BCF & 50MMBO OIIP
- Zarat development will add 2 MM m<sup>3</sup>/d of gas and 10 000 bbl/d of oil (production start expected for 2024).

Ashtart Sub Basin

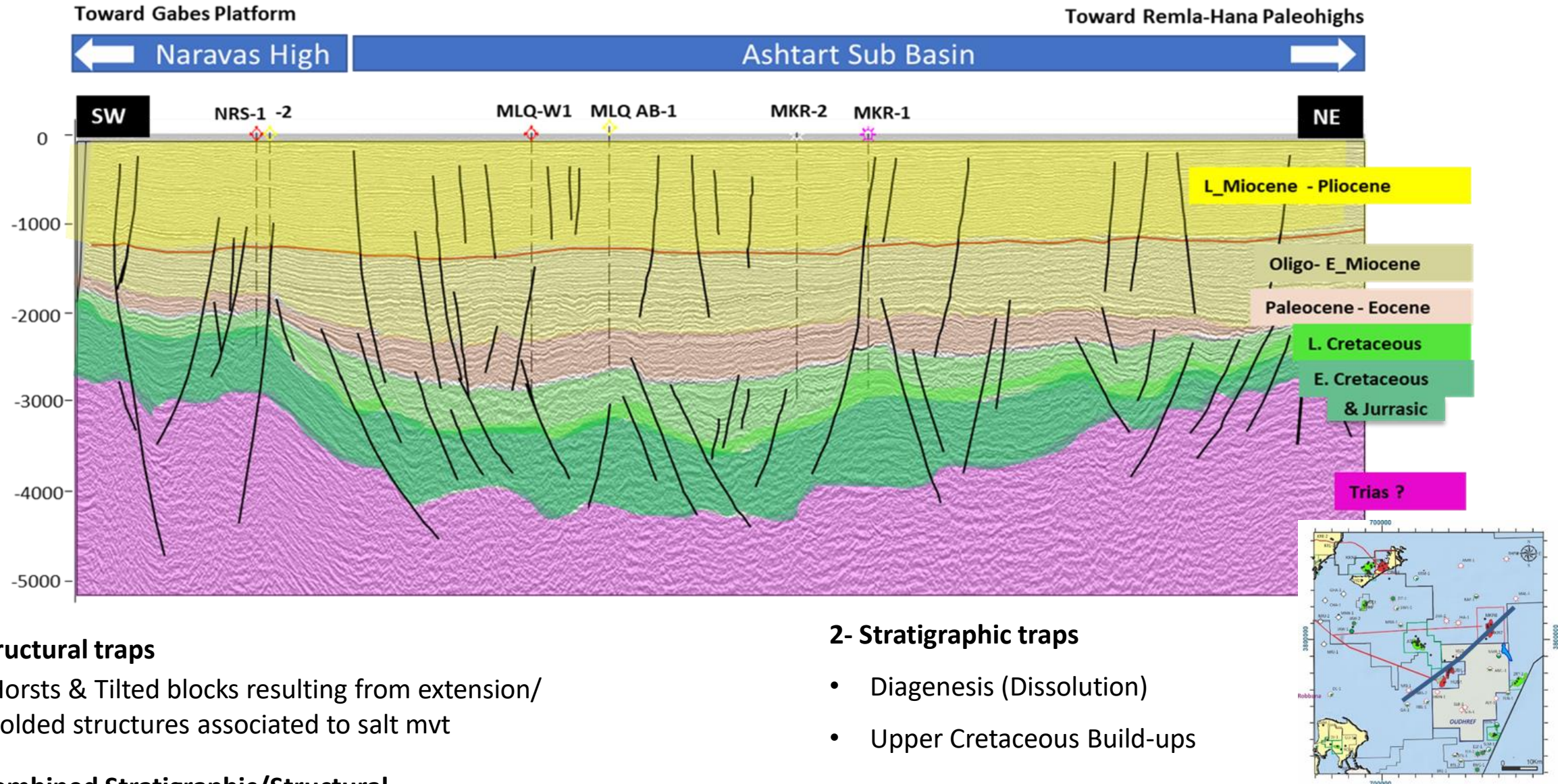


PS	Units	Parameters
 Sources	Albian Lower Fahdene	TOC: 0,7-2% Kerogene type II/III
	Cenomanian Turonian Bahloul	TOC: 1 to 6% Kerogene Type II
	Ypresian Bou Dabbous	TOC: 2-8 % Kerogene Type II
 Reservoirs	Ypresian El Guaria	Shallow marine Nummulitic limestone Ø = up to 27%
	 Eocene Souar Shales	K = up to 3400 mD
	Upper Senonian Abiod	Fractured Chalky limestone Ø = up to 25%
	 Paleocene El Haria Shales	K = 7mD enhance Diagenesis & Fracture
	Turonian-Coniacian Douleb Bireno	shallow marine bioclastic limestone Ø = up to 19%
	 Santonian Aleg Shales	K = up to 100 mD
Cenomanian Isis	Reefal Facies Ø = up to 20 %	
 Cenomanian Shales	K = up to 200 mD	





# Gulf of Gabes\_ Ashtart Sub Basin\_Regional Structural Style & trapping



## 1- Structural traps

- Horsts & Tilted blocks resulting from extension/
- Folded structures associated to salt mvt

## 3- Combined Stratigraphic/Structural

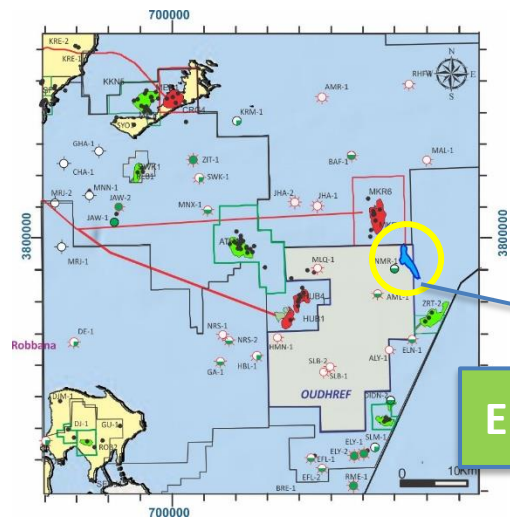
## 2- Stratigraphic traps

- Diagenesis (Dissolution)
- Upper Cretaceous Build-ups

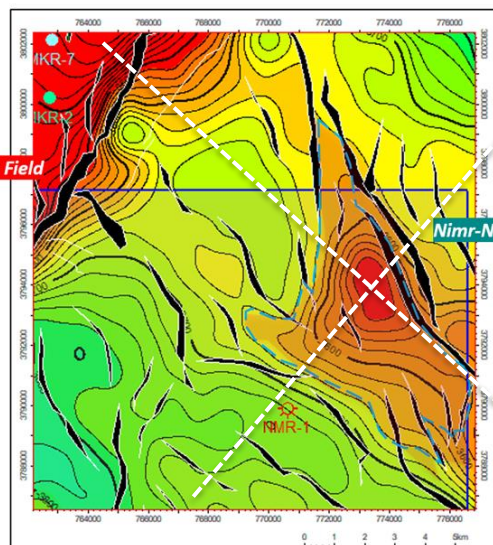


# Gulf of Gabes \_ Ashtart Sub Basin \_ Oudhref Open Block Opportunity

El-Nimr North Structure \_ Combined trapping

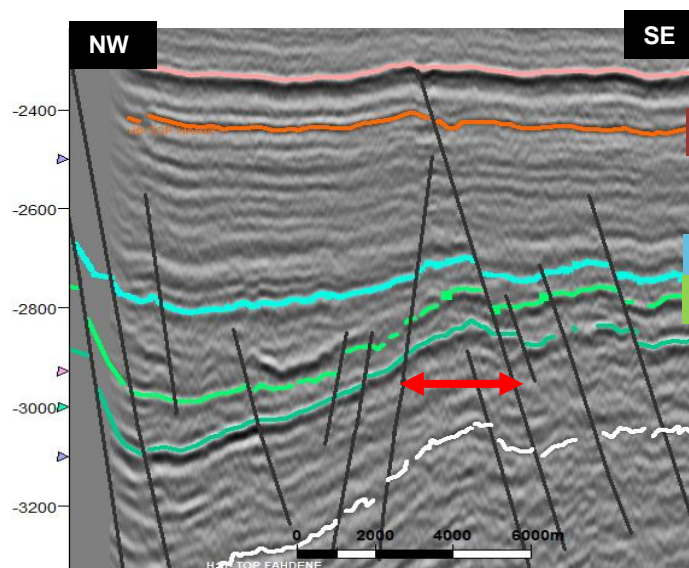
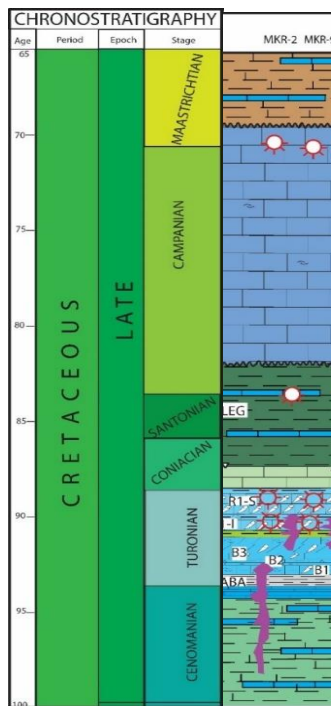
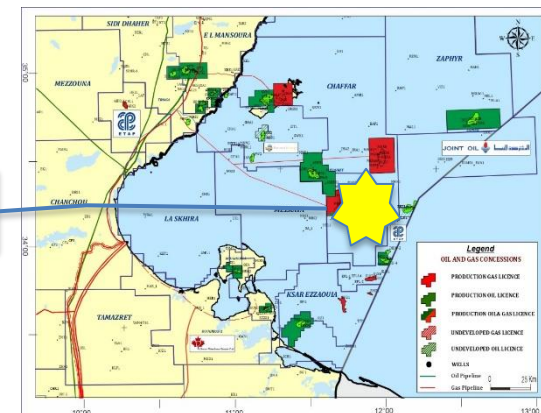


El Nimr North

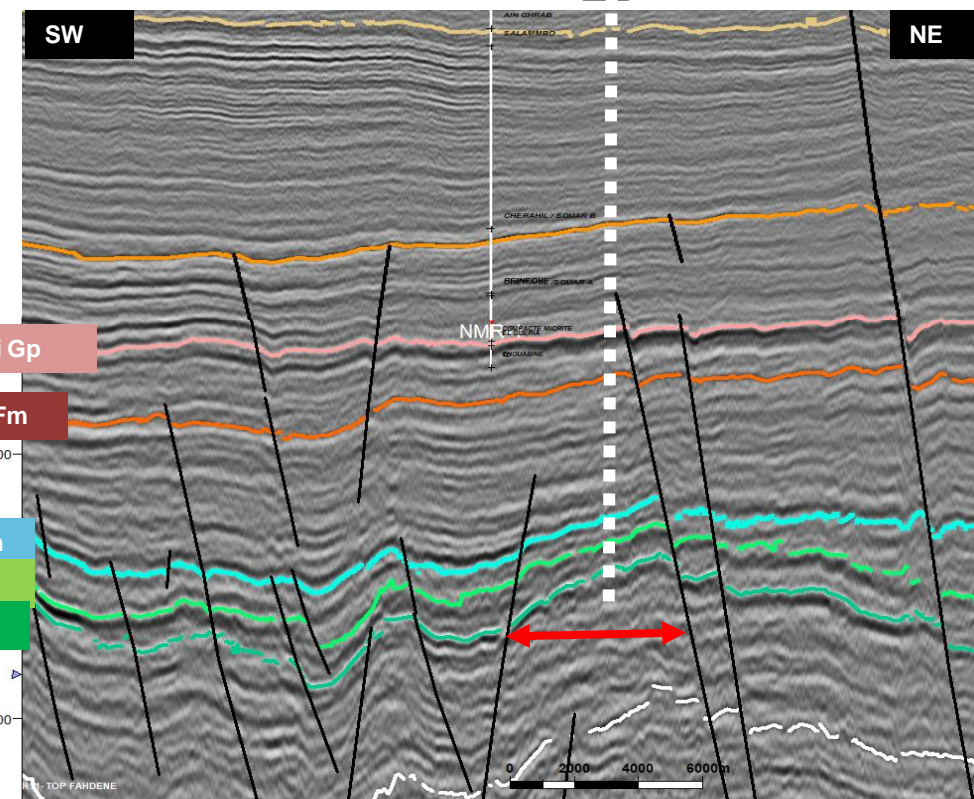


Oudhref OB

Bathymetry : 60 m



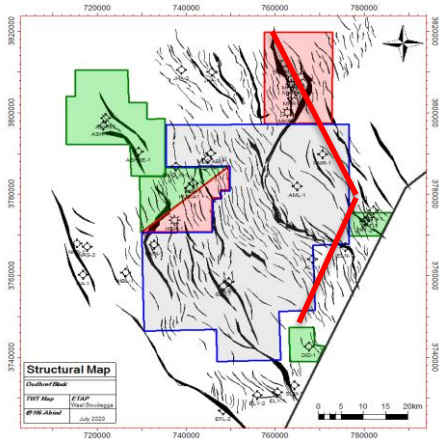
Metlaoui Gp  
El Haria Fm  
Abiod Fm  
Douleb  
Bireno



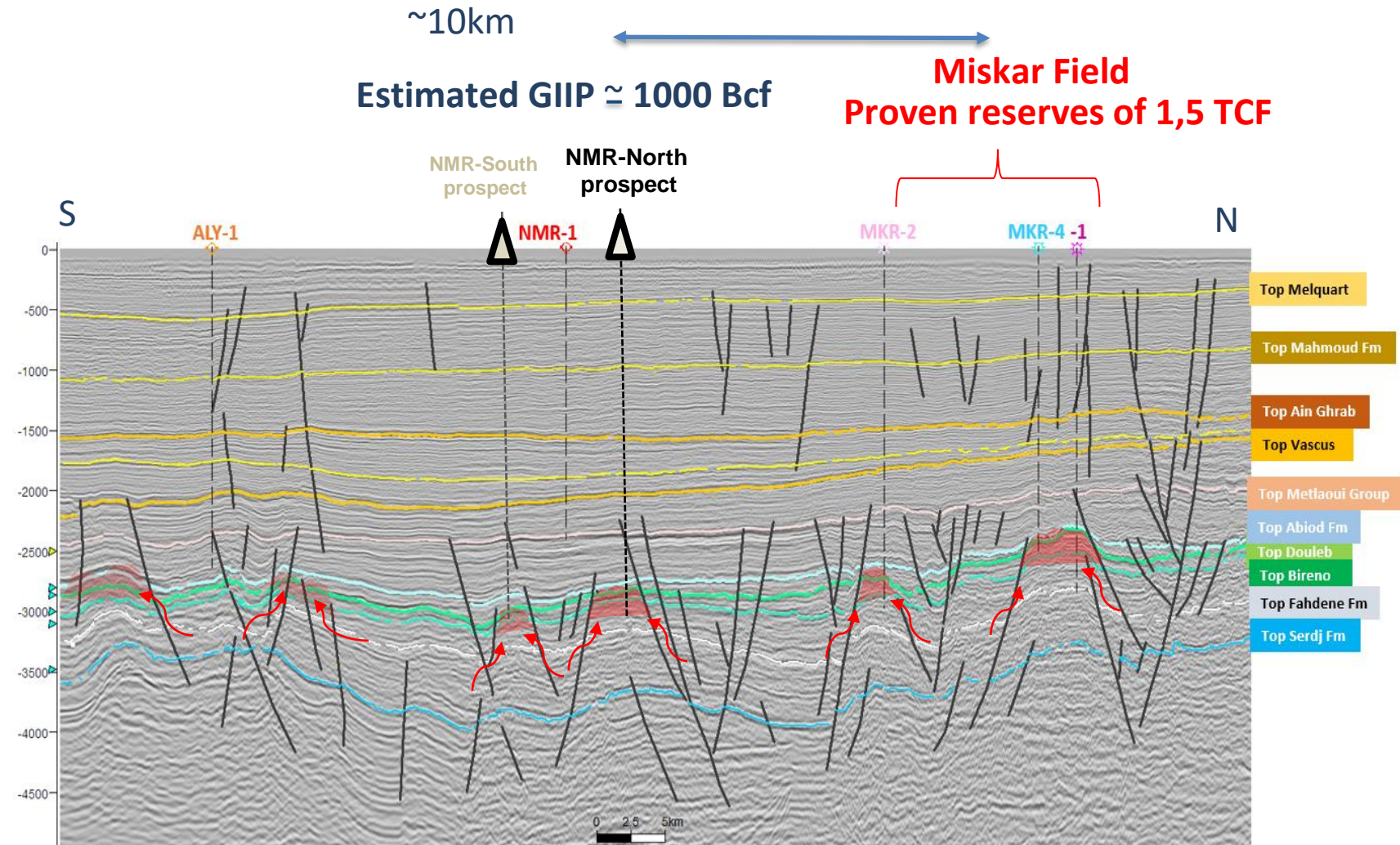
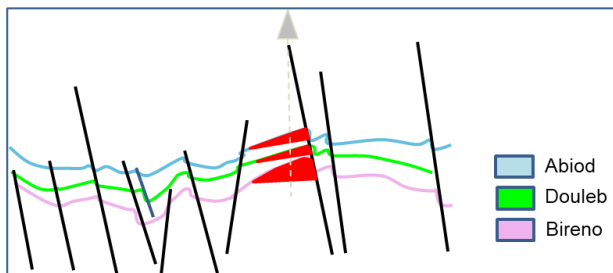


# Pelagian Basin\_Gulf of Gabes\_Oudhref Open Block Opportunity

## El-Nimr North Structure \_ Field Anlog



EL-Nimr North Prospect	Mean Unrisked GIIP (BCF)	Mean Recoverable Resources (BCF)
ABIOD	350	269
DOULEB	220	124
BIRENO	425	328
<b>TOTAL (Raw Gas)</b>	<b>995</b>	<b>721</b>





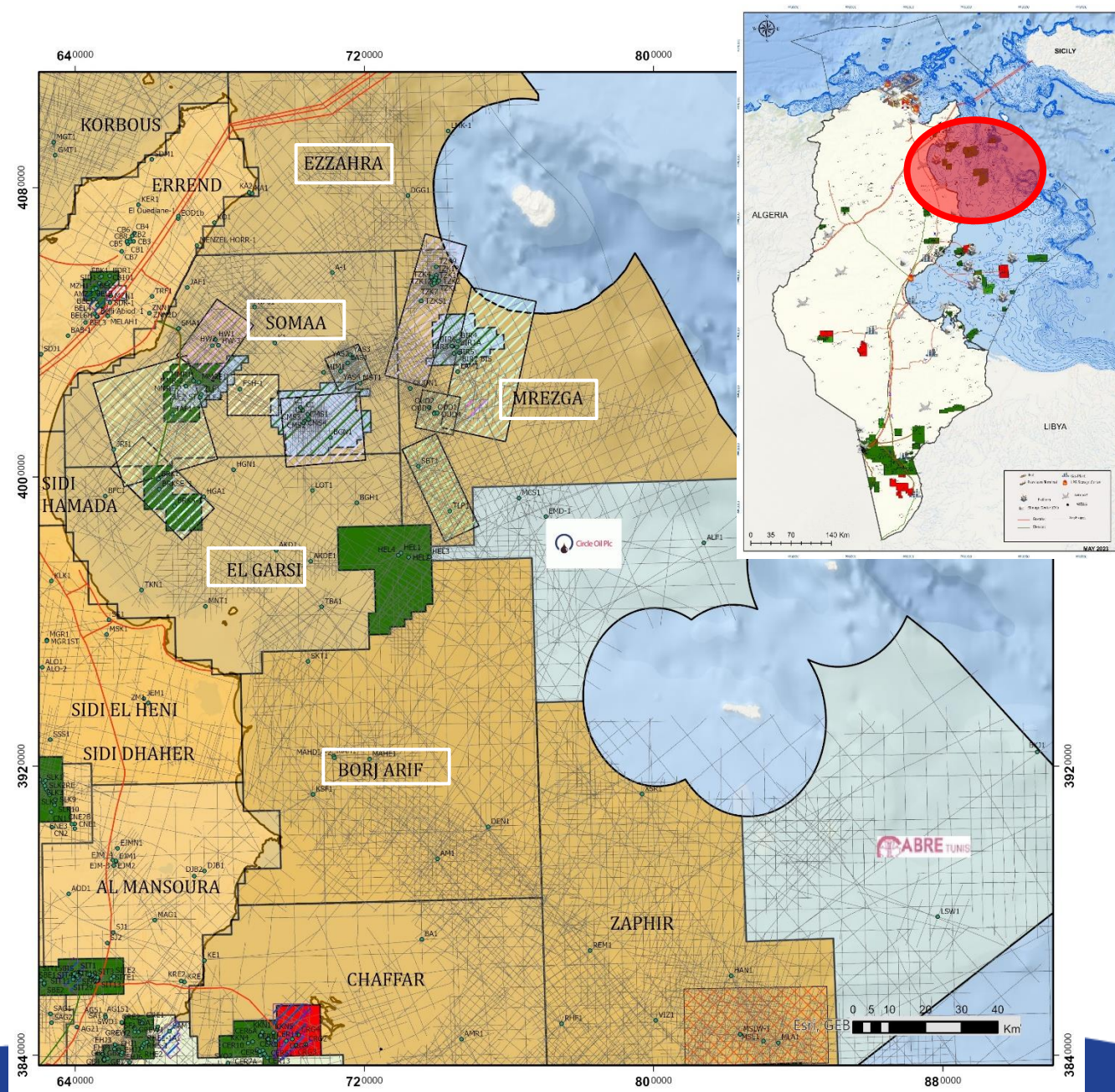
# Gulf Of Hammamet Exploration Opportunities

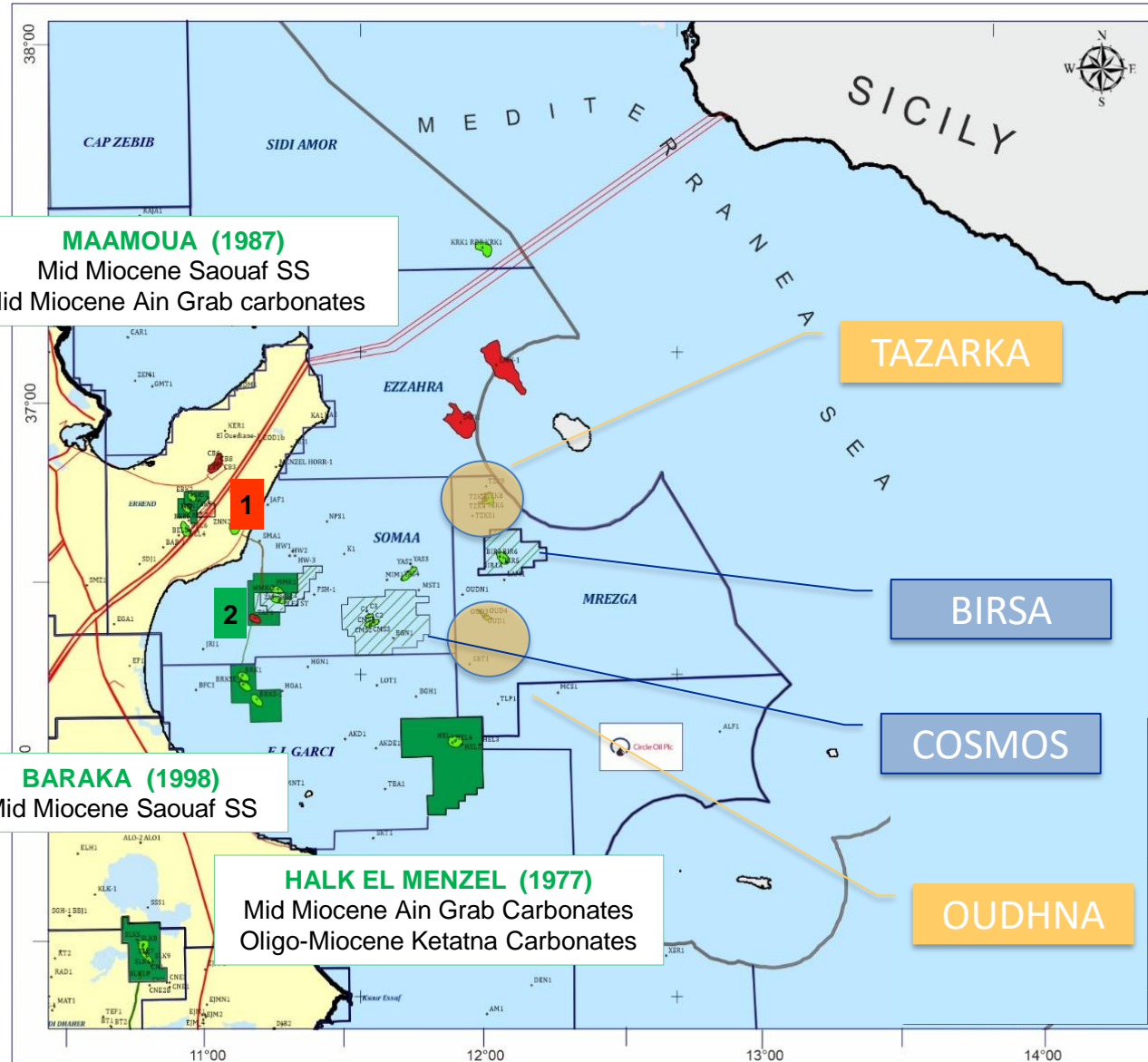
Hammamet





- Water Depth 0- 600m
- **90 Wells** (66 % Exploration, 24% Production)
- **Seismic: 40, 600 Km 2D & 11,000 SqKm 3D (37%)**
- **09 Discoveries**
- **3 Production Fields** ( Baraka, Maamoura, Helk El Menzel)
- **3 undeveloped oil fields** (Birsa , Zelfa & Cosmos)
- **1 Exploration Permit** (Circle Oil)
- **5 Open blocks**
  - ✓ Ezzahra ( 4200 Sq Km)
  - ✓ Soma ( 3624 Sq Km)
  - ✓ Mrezga (4200 SqKm)
  - ✓ El Garsi (3944 Sq Km)
  - ✓ Borj Arif ( 6352 SqKm)





## Oil&Gas Pipelines

- 1 Gas pipeline Maamoura –Tazerka 50Km 12 Inch
- 2 Oil pipeline Baraka –Tazerka 19Km 10 Inch

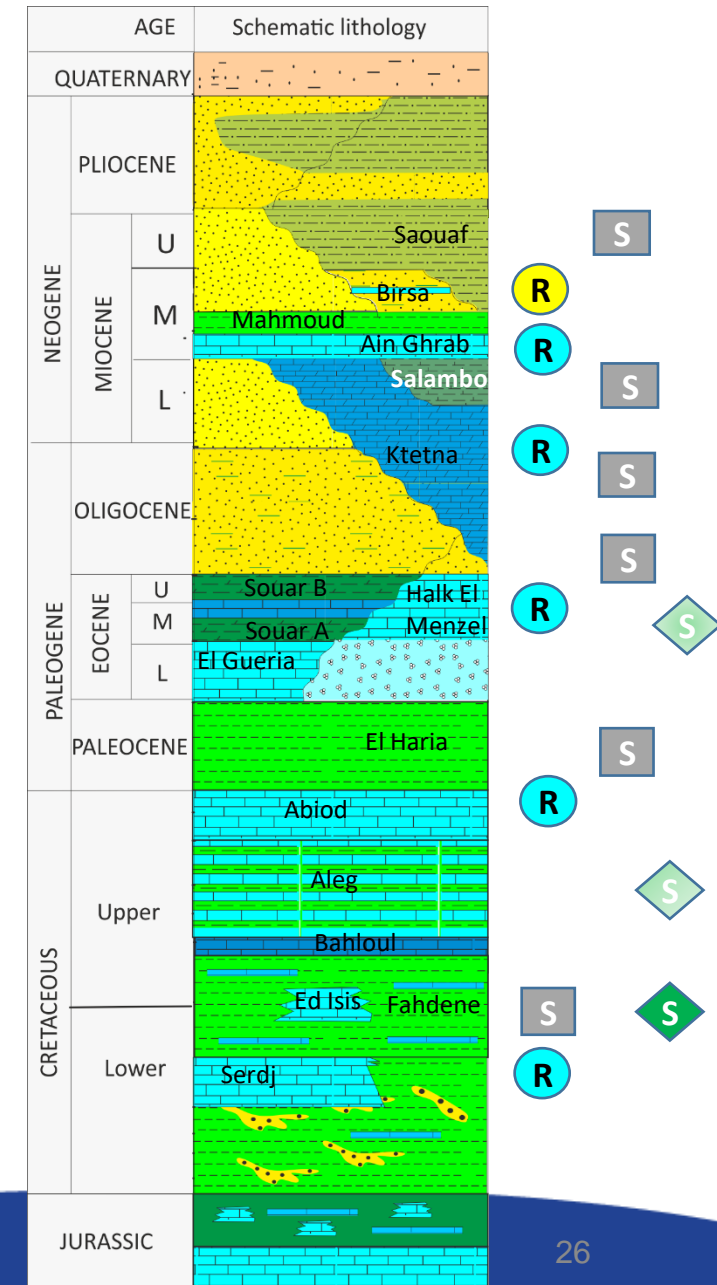
## Main Undeveloped Opportunities

- **BIRSA undeveloped field**
  - discovered 1976 Mid. Miocene Birsa sand bodies
  - OIIP 28 MMbl
- **COSMOS undeveloped field**
  - discovered 1981 Mid.Miocene Birsa sand bodies
  - OIIP 25 MMbbbl
- **OUDHNA depleted field**
  - discovered 1978 Mid. Miocene Birsa sand bodies
  - OIIP 24 MMBO , Produced 10MMbbbl
- **TAZARKA depleted field**
  - Discoverd Oil at Mid. Miocene Birsa sand bodies , Gas & Condensate at L. Cretaceous Abiod carbonates
  - OIIP 76MMbbbl, produced 22MMbbbl



# Pelagian Basin\_Gulf of Hammamet\_Petroleum Systems

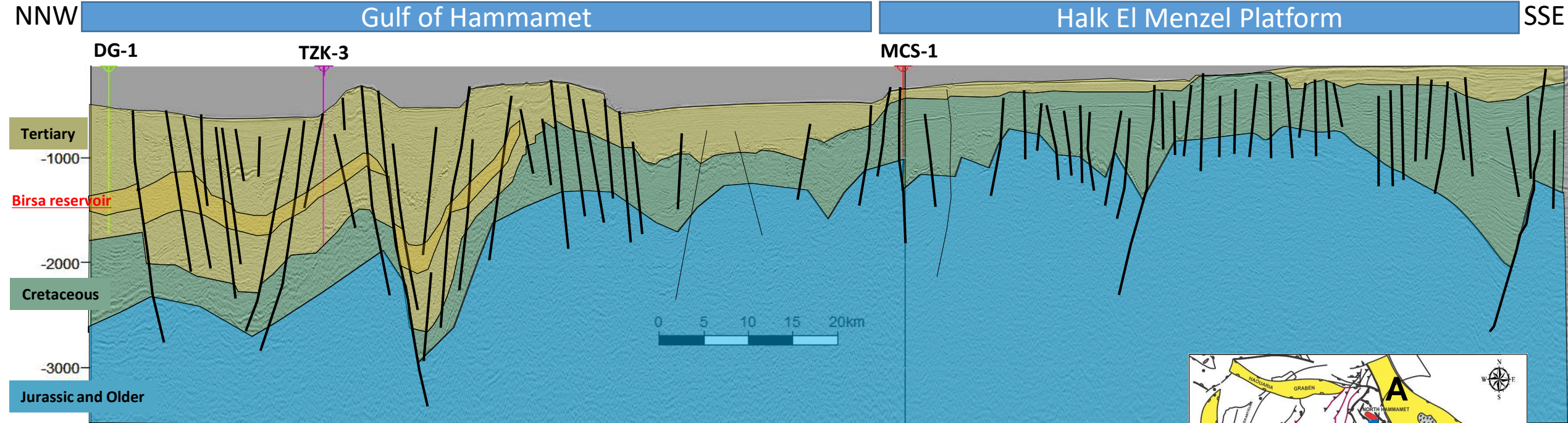
PS	Units	Parameters
<b>S</b> Source	Albian Lower Fahdene	TOC: 0,7-2% Kerogene type II/III
<b>R</b> Reservoir	Serevallian Birsa <b>S</b> U. Miocene Saouaf Shales	Shallow marine sandy bars Ø = up to 28% K = up to 1200 mD
<b>R</b> Reservoirs	Langhian Ain Grab <b>S</b> Serravallian Shales	Shallow marine carbonate Ø = up to 26% K = up to 100mD
	Oligo-Miocene Ketatna <b>S</b> Intraformational Shales	Shallow marine carbonate pf Ø = up to 30%
	Eocene Halk El Menzel <b>S</b> Intraformational Shales	Shallow marine carbonate pf Ø = up to 35%
	Upper Senonian Abiod <b>S</b> Paleocene El Haria Shales	Fractured Chalky limestone Ø = up to 2% K = 100mD Diagenesis & Fracture
	Albian Allam <b>S</b> Fahdene Shales	Marine carbonate pf Ø =
	Aptian Serdj <b>S</b> Fahdene Shales	Shallow marine carbonate pf Ø = % K =



# Palagian Basin\_Gulf of Hammamet\_Regional Structural Style & trapping

**A**

**B**



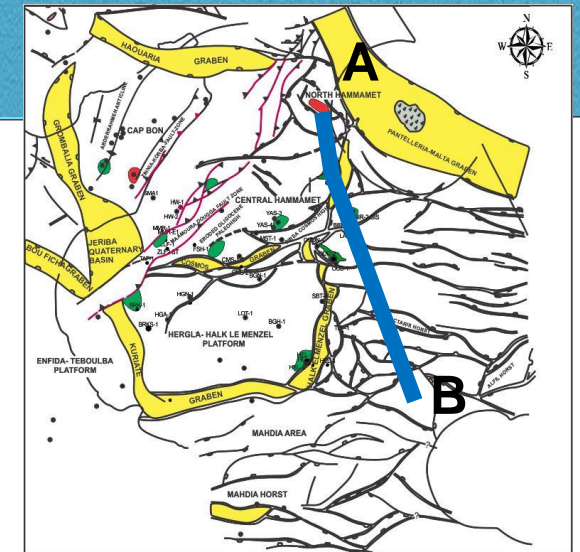
## 1-Structural traps

- Normal faulting
- Horst
- Tilted blocks
- Roll-over anticline

## 2-Stratigraphic traps

- Regional Unconformity ( Base Oligocene)
- Miocene Lenticular sandstones
- Upper Cretaceous Carbonates Build up

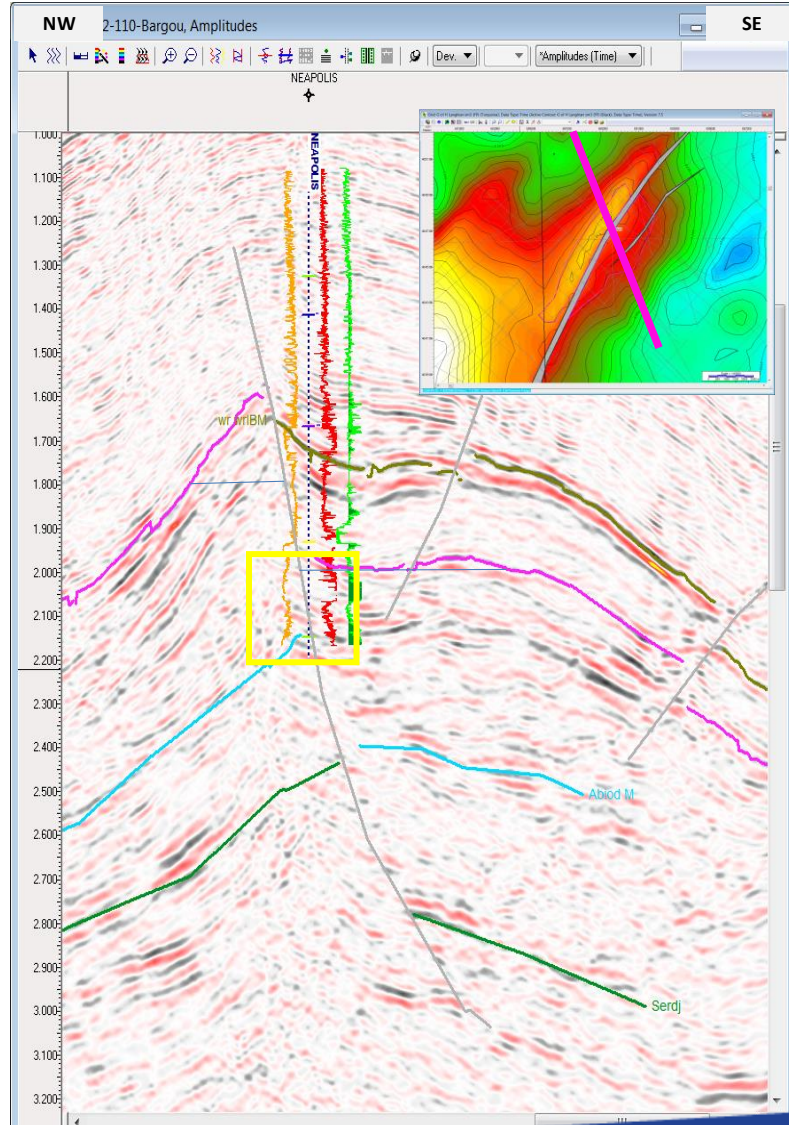
## 3-Combined traps





# Pelagian Basin\_Gulf of Hammamet\_Somaa Open Block Opportunity

## Neapolis NFR (Ypresian Oil Discovery)

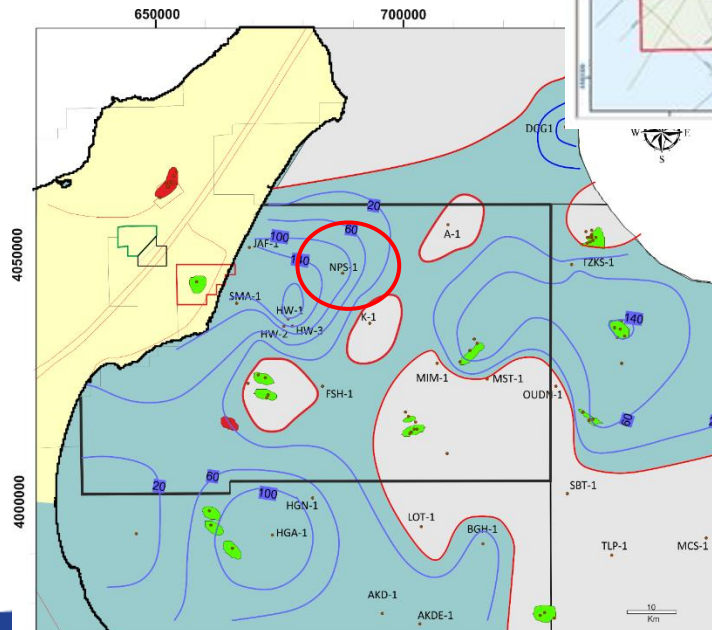


Water depth: ~80m

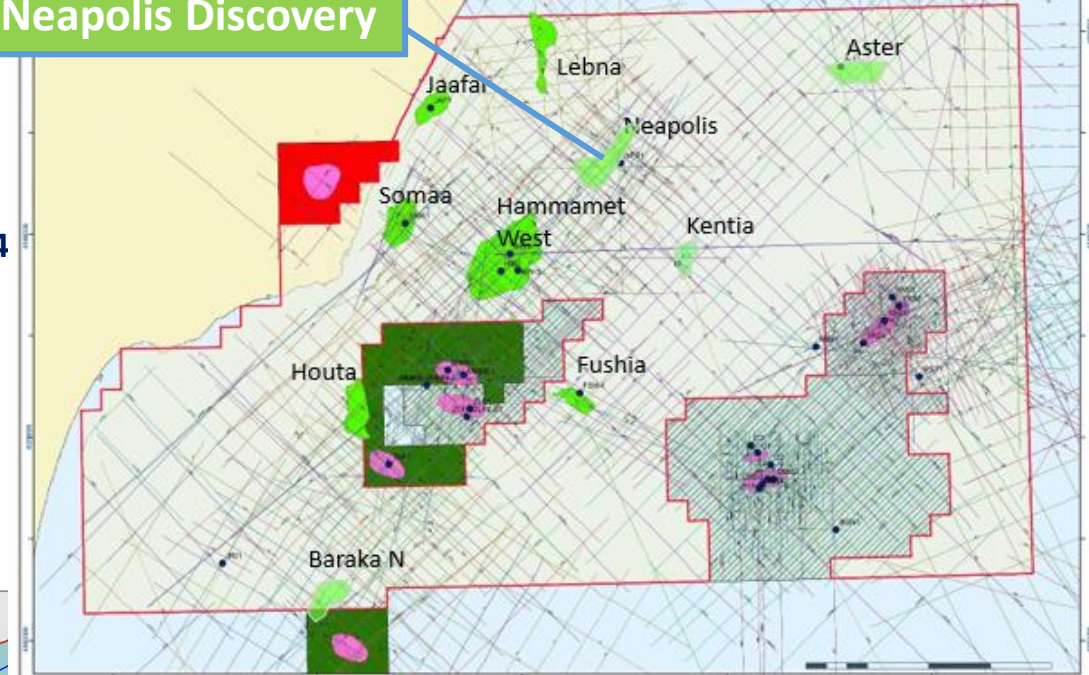
Unrisked STOIP 35MMbbl  
Chance of Success (expects) 0,14

NPS-1 well  
followed 500 bbl/day

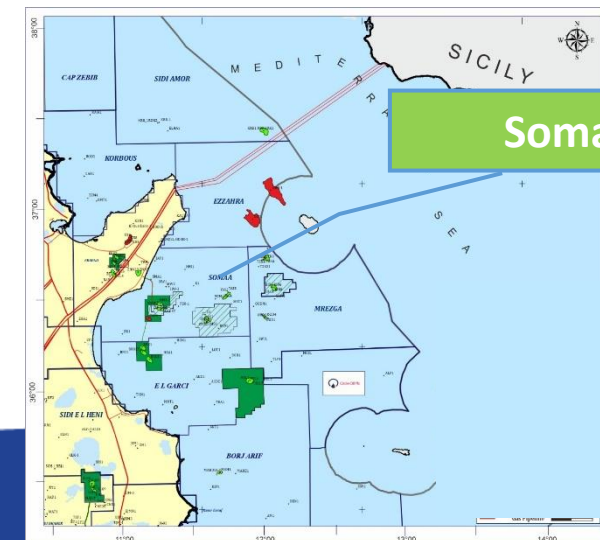
Thickness 100m Net pay 70m



## Neapolis Discovery



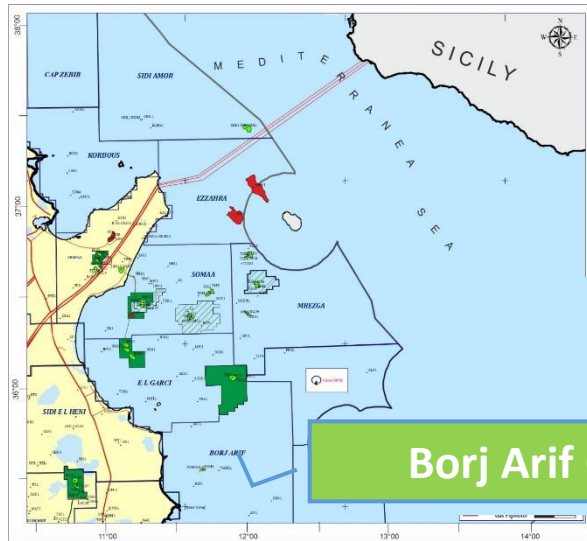
## Somaa OB



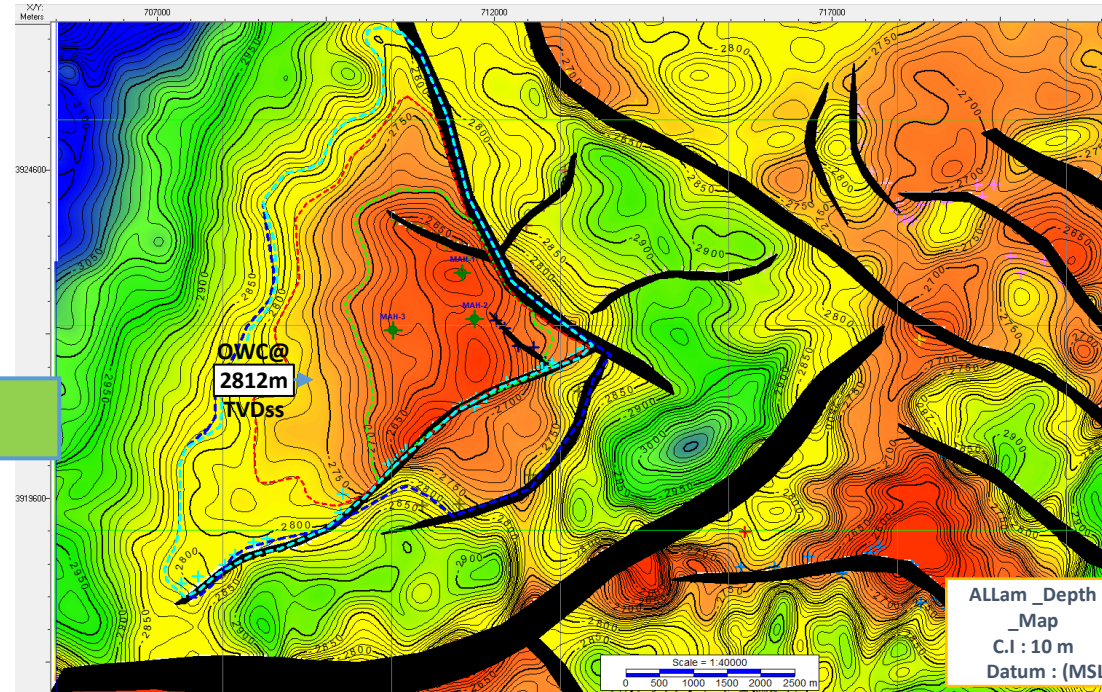


# Pelagian Basin\_Gulf of Hammamet\_Borj Arif Open Block Opportunity

## Mahdia Aptian-Albian Oil Discovery



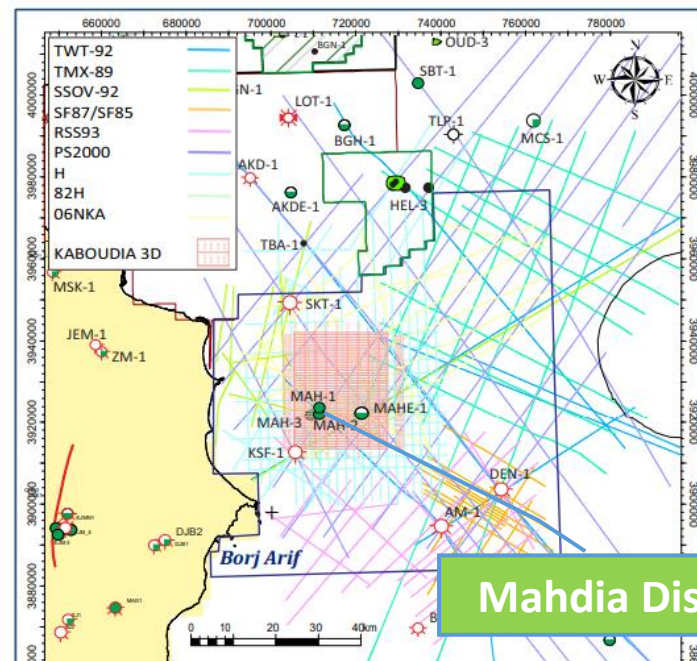
Borj Arif OB



MAH-1: Drilled in 1974 (Aquitaine) ,  
450 BOPD from Aptian Serdj

MAH-2: Drilled in 2011 (Numhyd) ,  
1700 BOPD Serj & Allam

MAH-3: Drilled in 2016 (Numhyd)  
423 BOPD from Allam



Mahdia Discovery

WD less tha 50m  
Area P10 Allam 23 Sq Km  
Area P10 Serj 5.5 SqLm  
OWC 2812 m  
STOIP (P10) 88 MMBO (71 & 17)  
Recoverable resources (P10) 15 MMbbls (11 & 4)

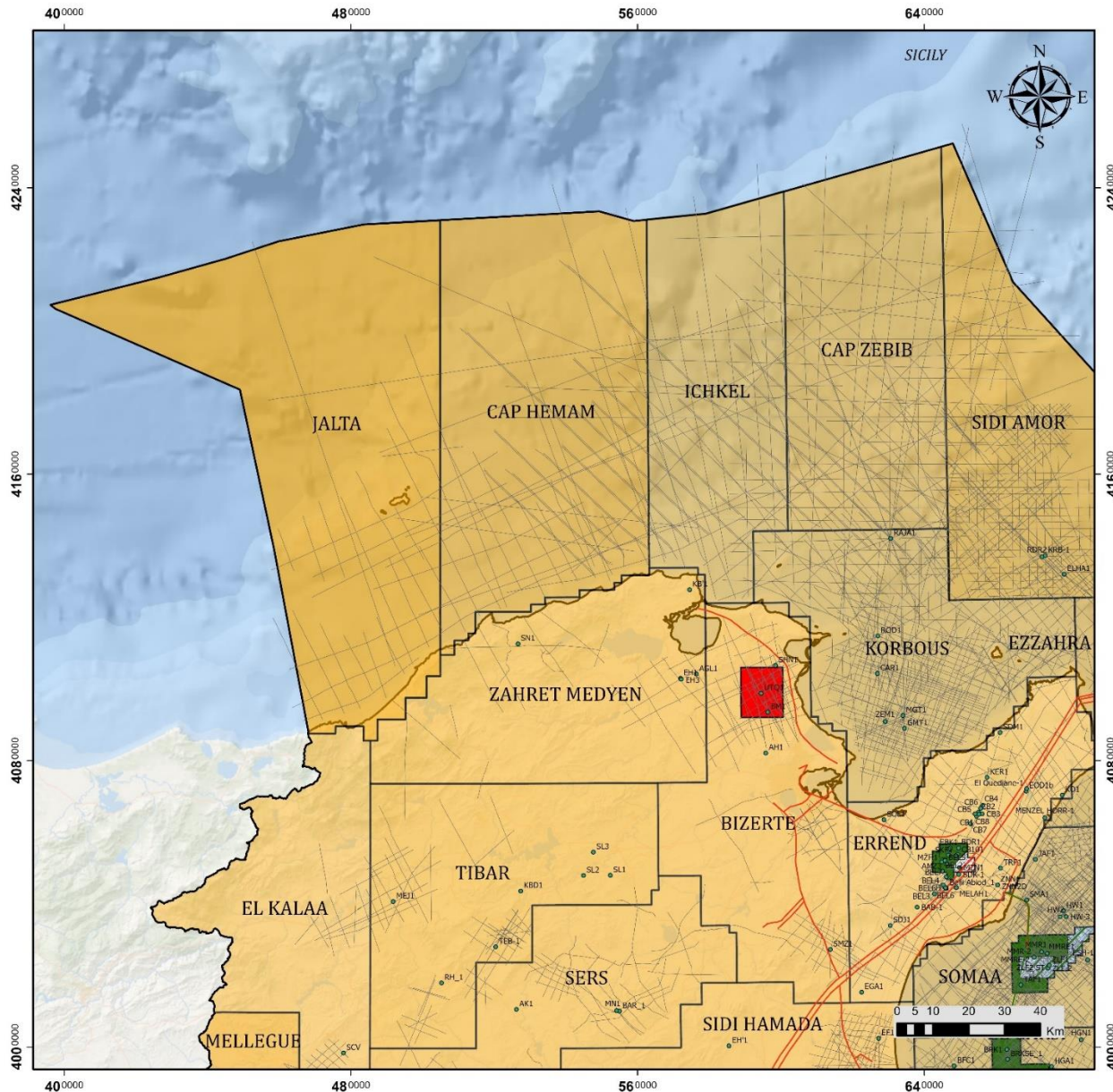


# North Onshore & Offshore





# Challenges and Opportunities in Frontier Basin



- **1 Production License ( Utique 100% CO2)**

- **10 Open Blocks**

- \* 4 Onshore Blocks

Tibar, Zahret Medyen, Bizerte, El Kalaa

- \* 6 Offshore Blocks

Jalta, Cap Hemam, Ichkel , Cap Zebib , Sidi Amor, Korboous

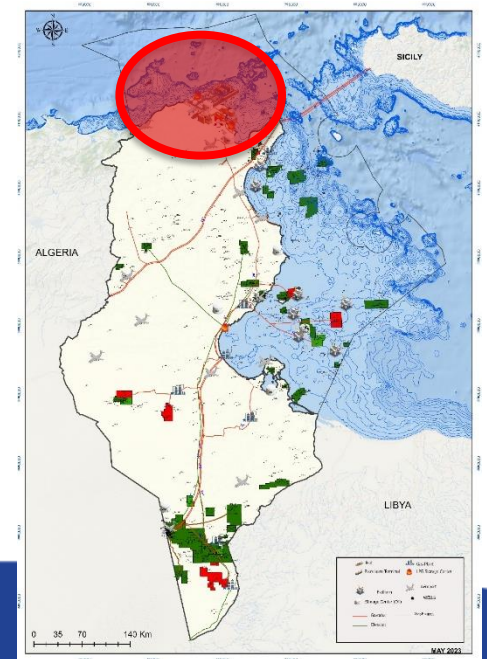
- **Seismic Coverage 17 000 Km 2D, 200 Sk sq 3D**

- **Wells**

9 Offshore drilled during the eighties  
16 Onshore ( last one drilled in 2015)

- **Bathymetry**

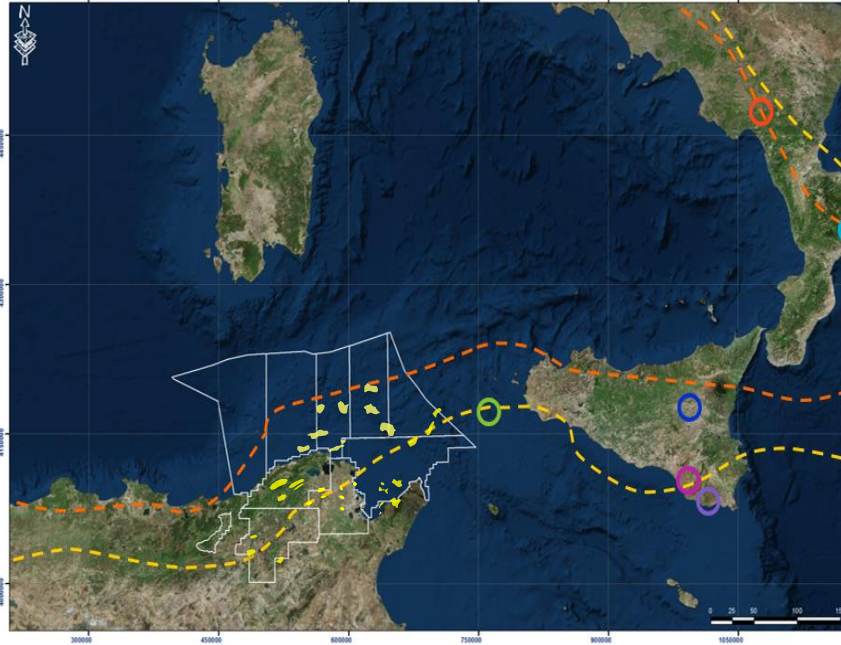
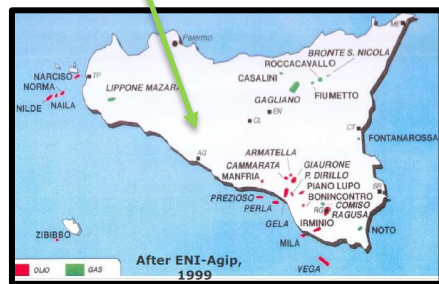
Mainly between 10 to 300m  
(Could exceed 1000 m around sicily channel and the northern border of the country)







Underexplored in Tunisia



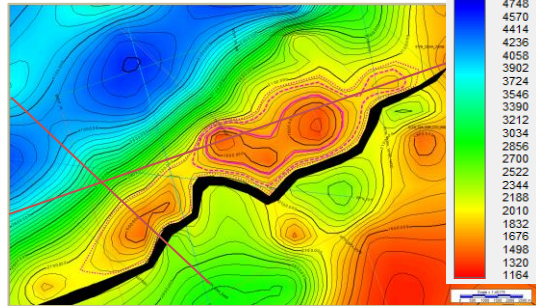
- Panda: 710 BCF Pliocene Sandstone
- Galliano: 400 BCF Oligo-Miocene SS
- Gela: 183 MM Trias-Lias Lms
- Ragusa: 194 MM, Trias– Lias Lms
- Val d'Agri: 1.02 BBOE, Mesozoic Lms
- Luna: 1.3 TCF, Miocene SS

- Analogue To Italy Domain
- Multiple Oil and Gas seeps
- Good stratigraphic control (Outcrop Data)
- Active Petroleum Systems
- Mature Source Rocks
- Carbonates and Clastics Reservoirs
- Nemereous Large structures

## Northern Tunisia Thrust & sub-thrust plays

### NUMIDIA Lead

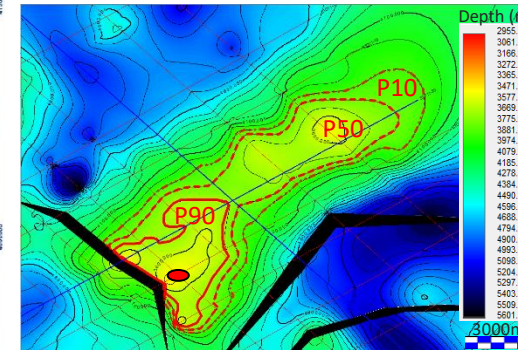
NUMIDIA LEAD DEPTH MAP AT TOP ABIOD FM.



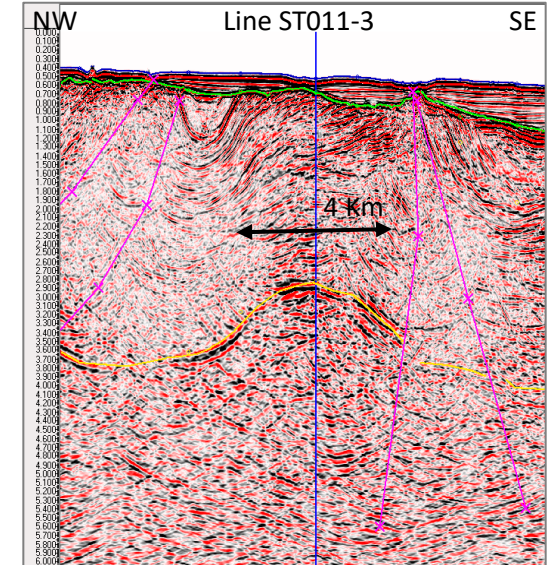
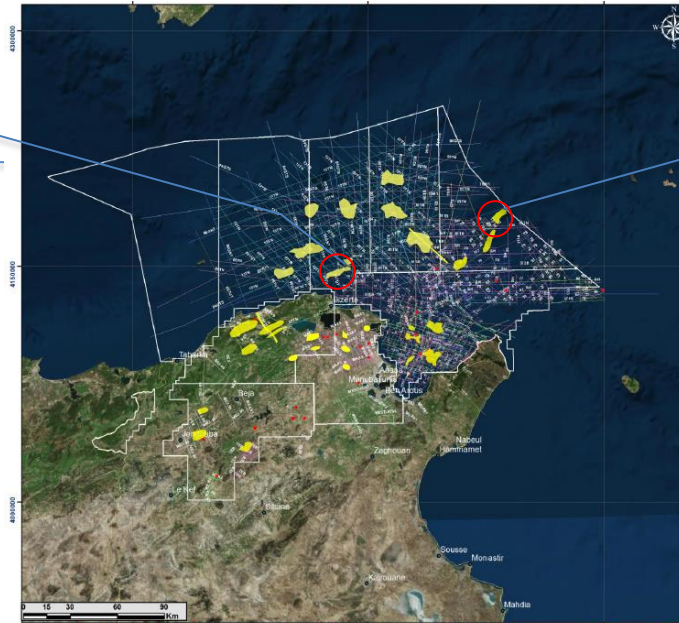
- Water Depth ranging from 100m to 200m
- Area (P10) 32 SqKm
- Abiod Depth (P10) 2025
- STGIIP ( P10) 900 BCF
- Unrisked Prospective Resources (P10) 600BCF

### Pilau Lead

PILAU LEAD DEPTH MAP AT BOU DABBOUS FM.

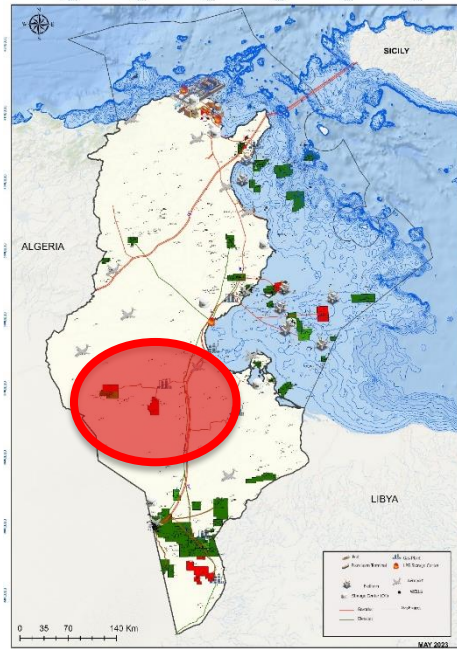


- Water Depth around 500m
- Area (P10) 60 SqKm
- Bou Dabbous Depth (P10) 3700
- STGIIP ( P10) 3500 BCF
- Unrisked Prospective Resources (P10) 1800BCF



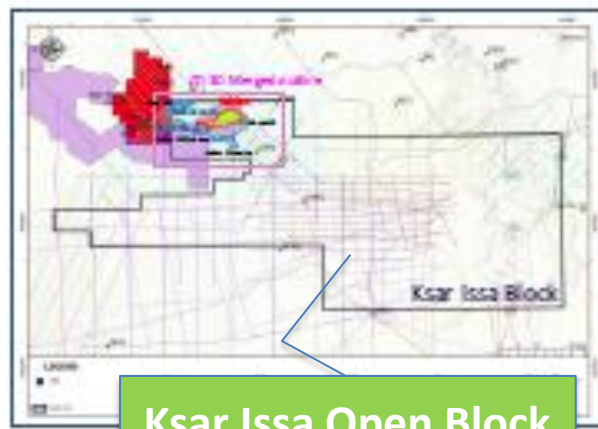
**High risk - High reward**



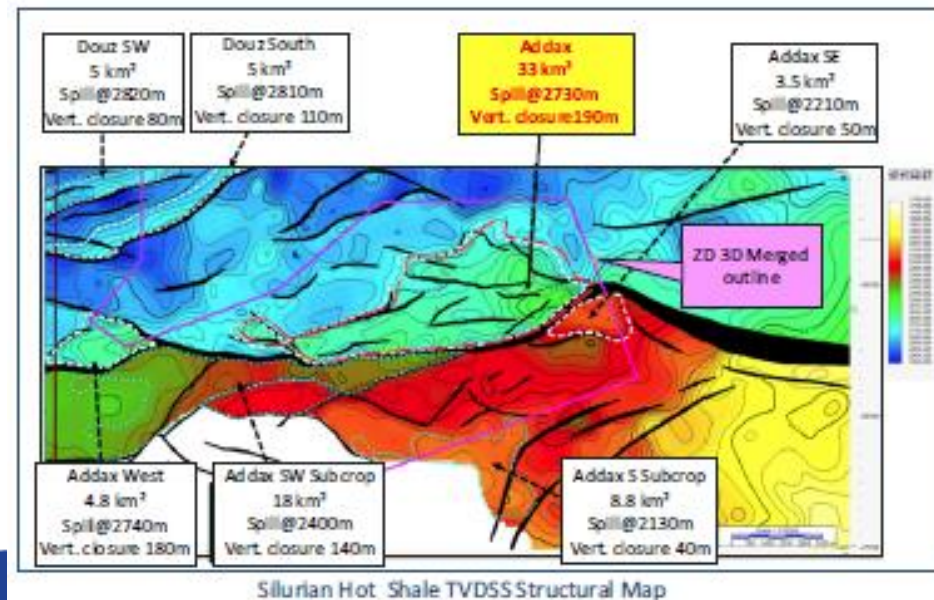


## Chotts Basin is hot spot because of the good Rate of Success

- The Lower Ordovician El Hamra reservoir is the main producing reservoir in the area and the oil rate from a single well could reach **5000 BOPD**.
- **2019, New Silurian Play Discovery**, Zaafrane Permit ( Chotts Basin) SMG-1 discovery which tested 2100 bbls and 5600 MSCF from Silurian Fegueguira Sand Bodies
- **2020, New Permian Play Discovery**, Baguel Concession ( Chotts Basin) TRF-6 discovery which tested tested 4.1 MMSCFD and 336 BOPD with BSW=0 from Permian Carbonates Levels



**Ksar Issa Open Block**



## ADDAX structure (P10) 3D Seismic

Multi Reservoirs ; Silurian/Ordovician

Area: 33 sqkm

Reservoir Depth : 2730 m

Vertical closure: 100m

Mean OOIP 150+115=265 MMbbls

Mean GIIP 241+ 185 ( 426 BCF)





Thank you for your attention



ETAP BOOTH N° 557

