



Kingdom of Morocco



المكتب الوطني للهيدروكربونات والمعادن
OFFICE NATIONAL DES HYDROCARBURES ET DES MINES

ONSHORE / OFFSHORE & NEW SHAPE POTENTIAL OF MOROCCO



AAPG 2012
INTERNATIONAL CONFERENCE & EXHIBITION

16-19 SEPTEMBER 2012
MARINA BAY SANDS EXPO AND CONVENTION CENTER

**ASIA PACIFIC RESOURCES:
FUELING THE FUTURE**




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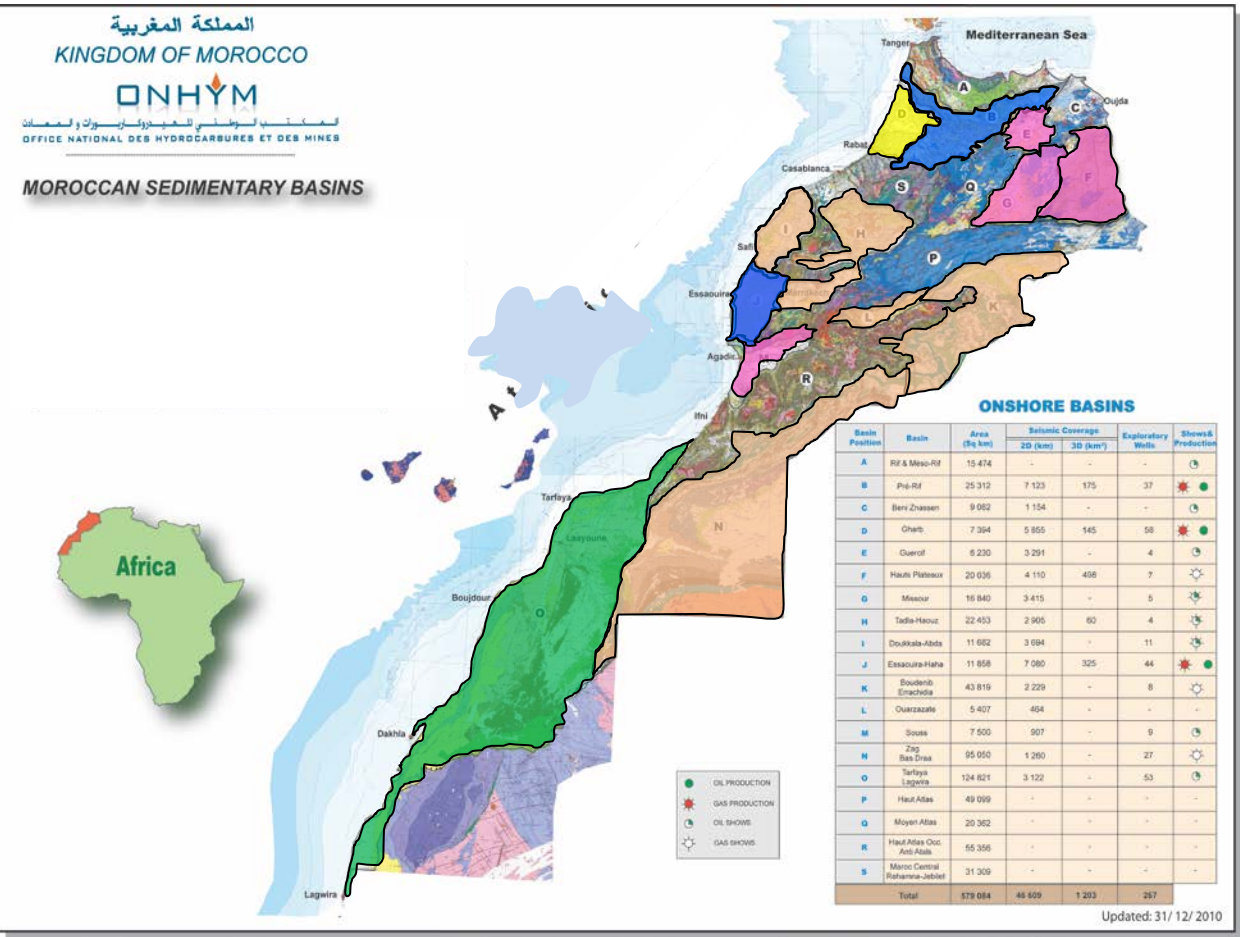
Key aspects of Morocco

- Political and economic stability;
- Economic policy of integration at regional and international levels;
- Growing and developing infrastructure projects;
- Energy policy based on developing partner's activities in the petroleum research;
- Favourable and attractive hydrocarbon's terms.

ONHYM Perspectives

- Opening of new frontier areas for exploration;
- Use of new technology tools in the exploration phase (onshore and offshore);
- Exploration and development of new resources (Oil Shale, Shale Gas & Shale Oil).

Geological Snapshot : Onshore



Paleozoic :

Zag (N), Boudenib (K),
Ouarzazate (L), and Tadla (H)

Triassic :

Essaouira (J),Souss (M), Guercif
(E), High Plateaux (F) and
Missour (G)

Jurassic :

Laayoune (O), Tarfaya (O),
Essaouira (J), Prerif (B)

Cretaceous :

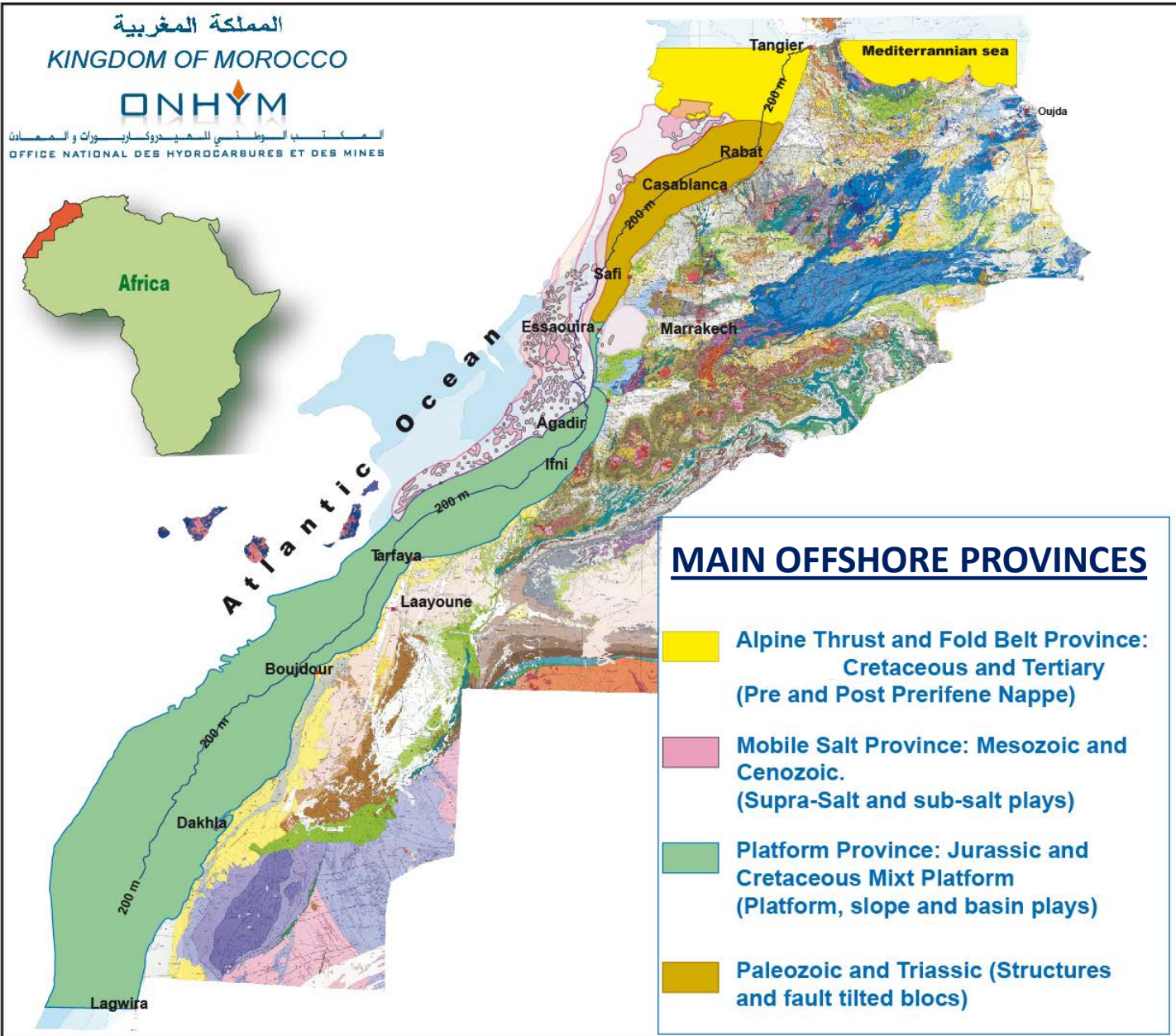
Tarfaya (O), Boujdour (O)

Tertiary:

Gharb (D)

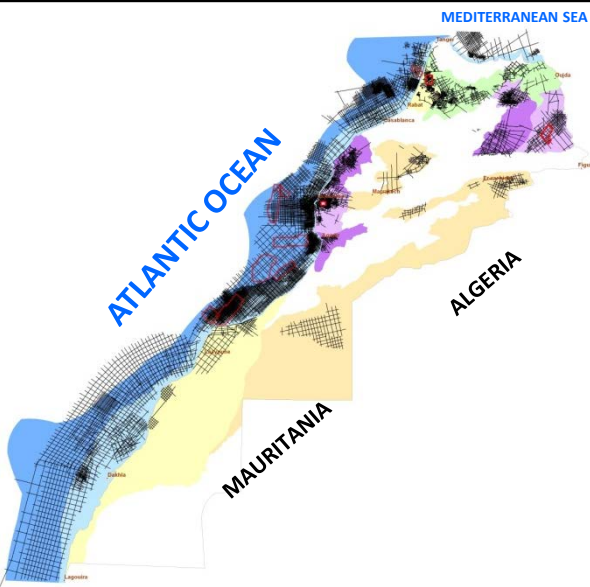
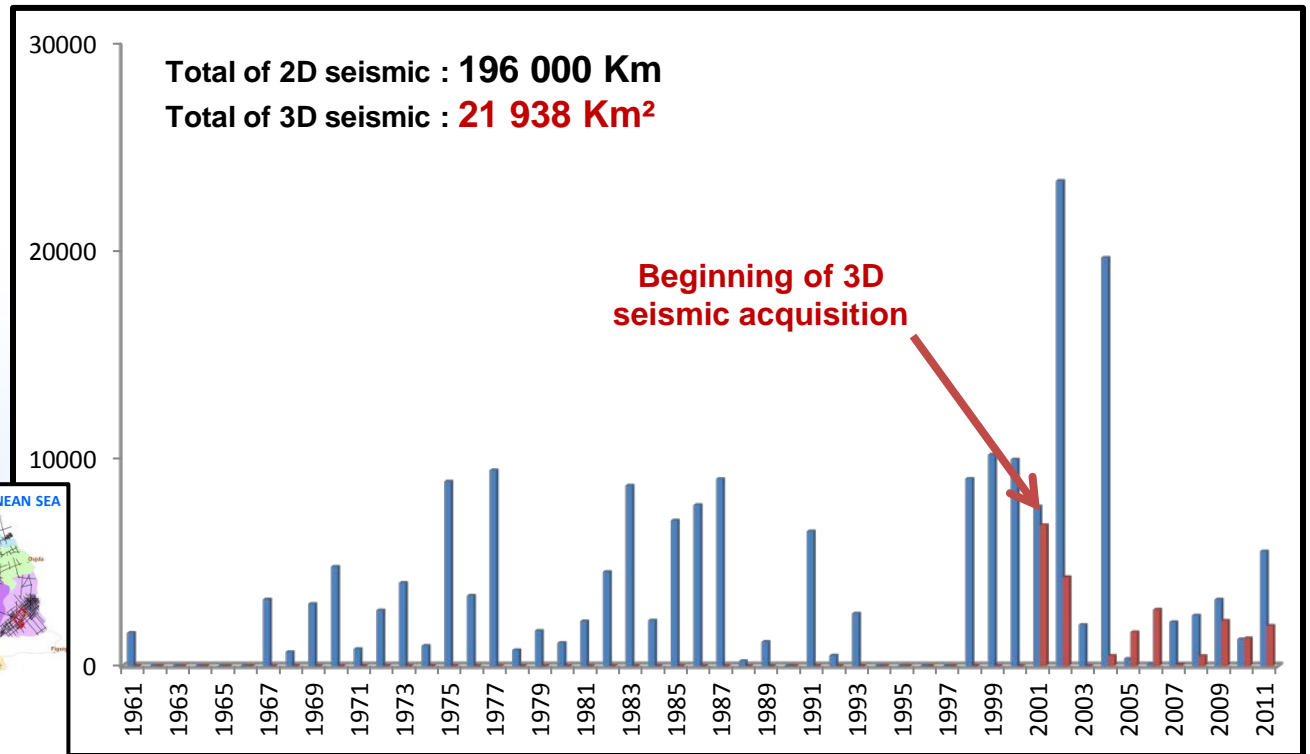


Geological Snapshot : Offshore



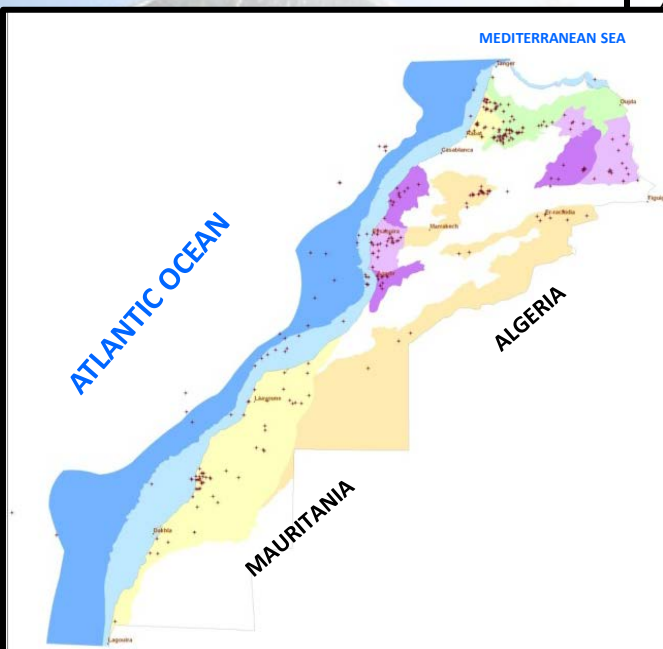
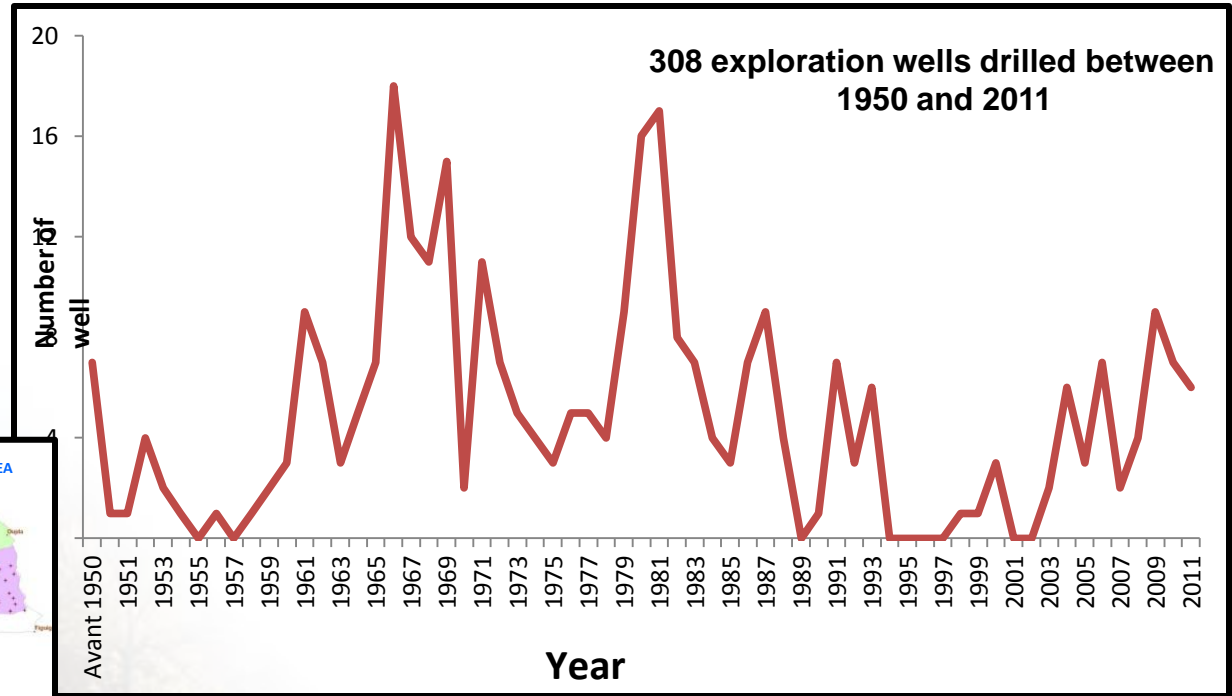
Exploration History

Seismic acquired between 1961 et 2011

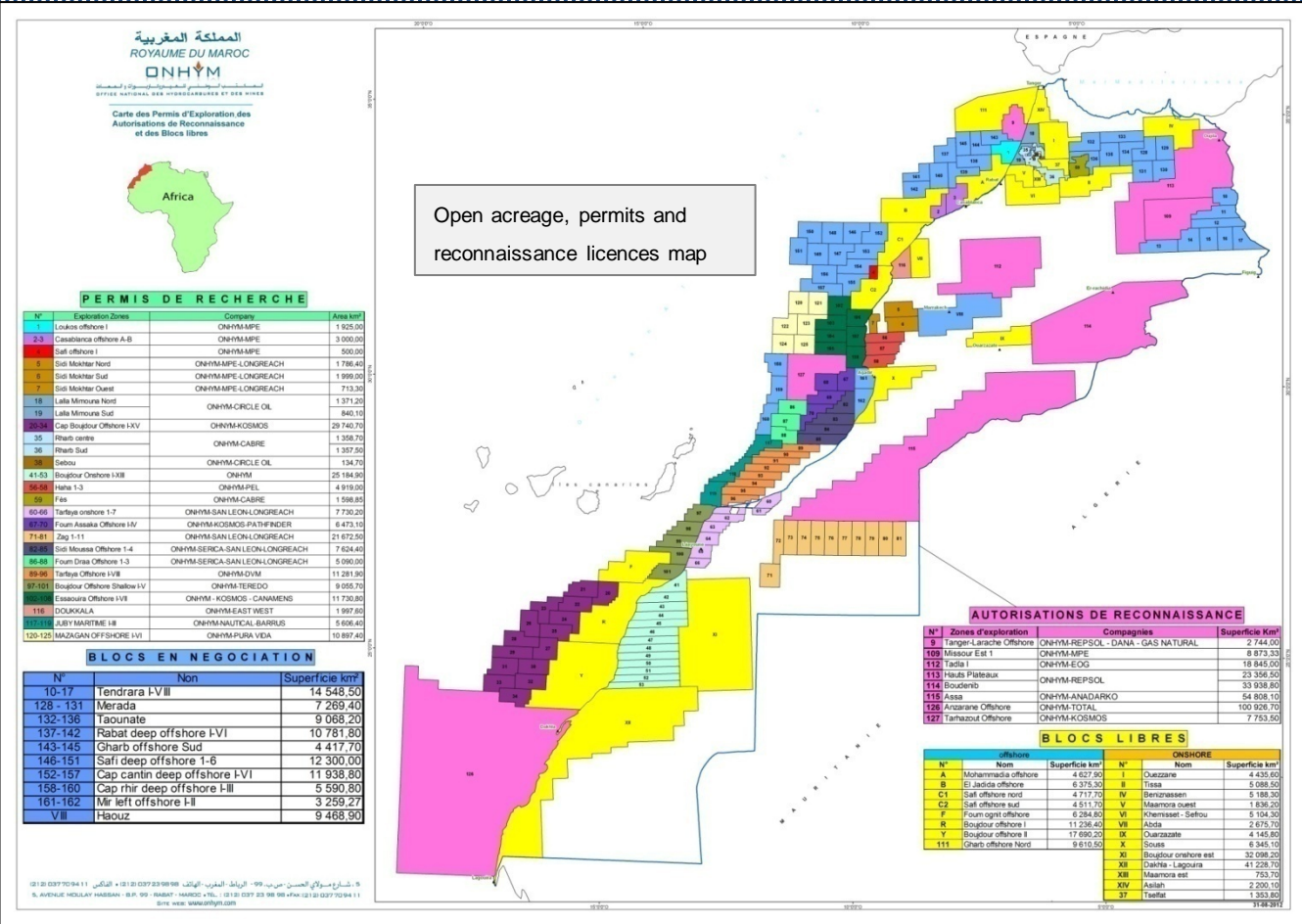


Exploration History

Evolution of wells numbers between 1950 and 2011



Exploration Status



Open acreage

- 08 blocs offshore
- 13 blocs onshore
- 10 blocs under negotiation

PA & RL

- 26 Petroleum Agreements offshore & onshore
- 08 Reconnaissance Licences (5 onshore and 3 offshore)

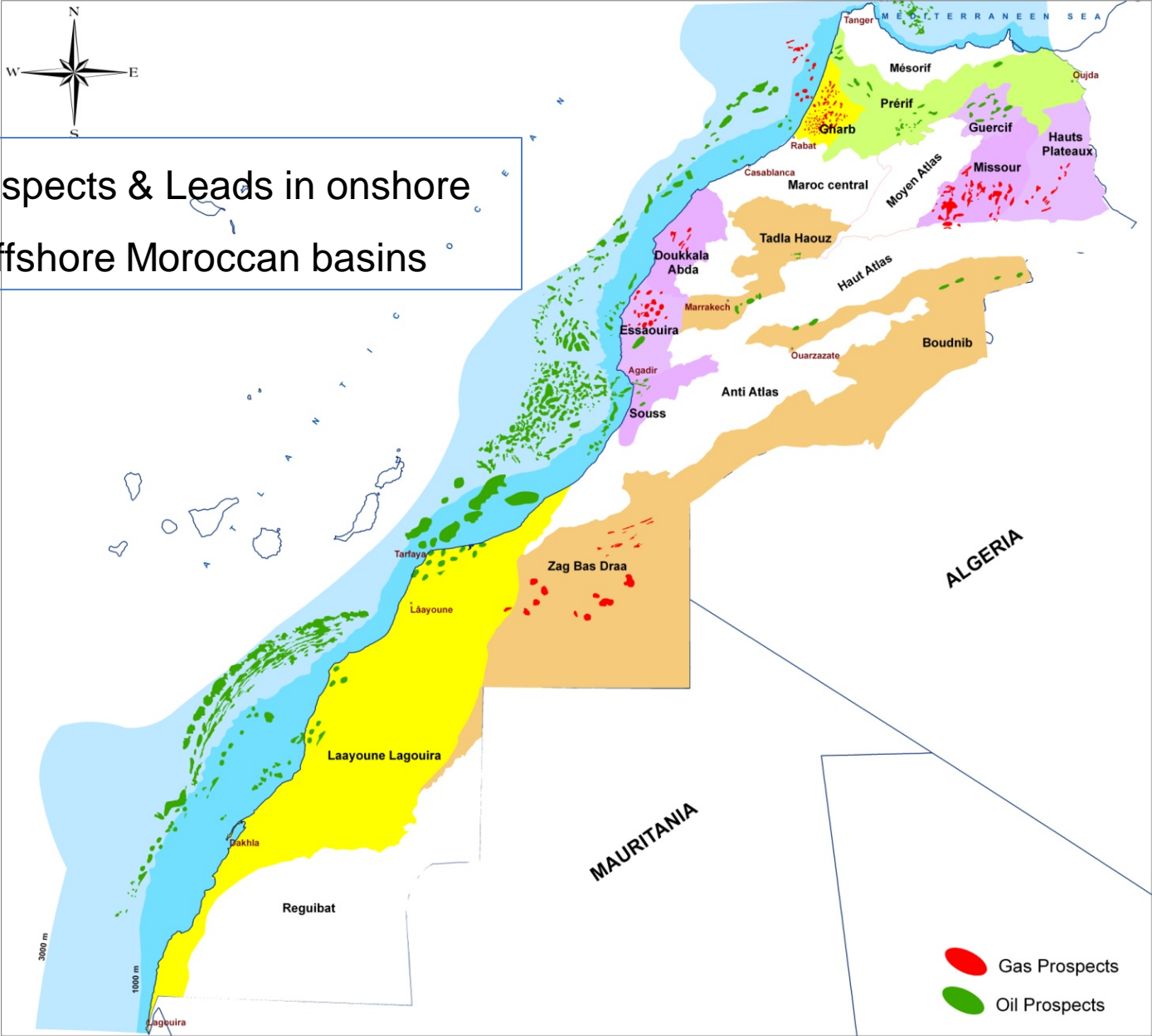


Petroleum System Summary

- The Essential elements to a working Hydrocarbon systems have been proven in the Onshore and Offshore Moroccan sedimentary basins;
- Evidence from hydrocarbon occurrences (discoveries, shows, surface oil seeps), outcrops and seismic indicators(HDIs, BSRs);
- Source rocks : Silurian-Devonian, Toarcian, Oxfordian, Aptian-Albian, Cenomanian-Turonian, Eocene-Miocene;
- Reservoir rocks: Devonian, Triassic, Jurassic, Lower Cretaceous, Coniacian, Miocene, Oligocene;
- Sealing Rocks: Triassic salt, Jurassic anhydrites, Cretaceous and Tertiary shale.

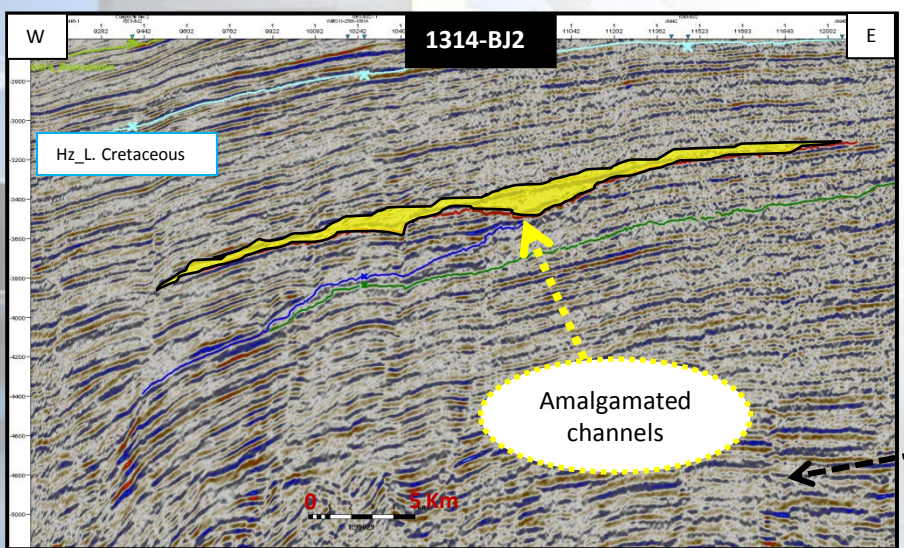
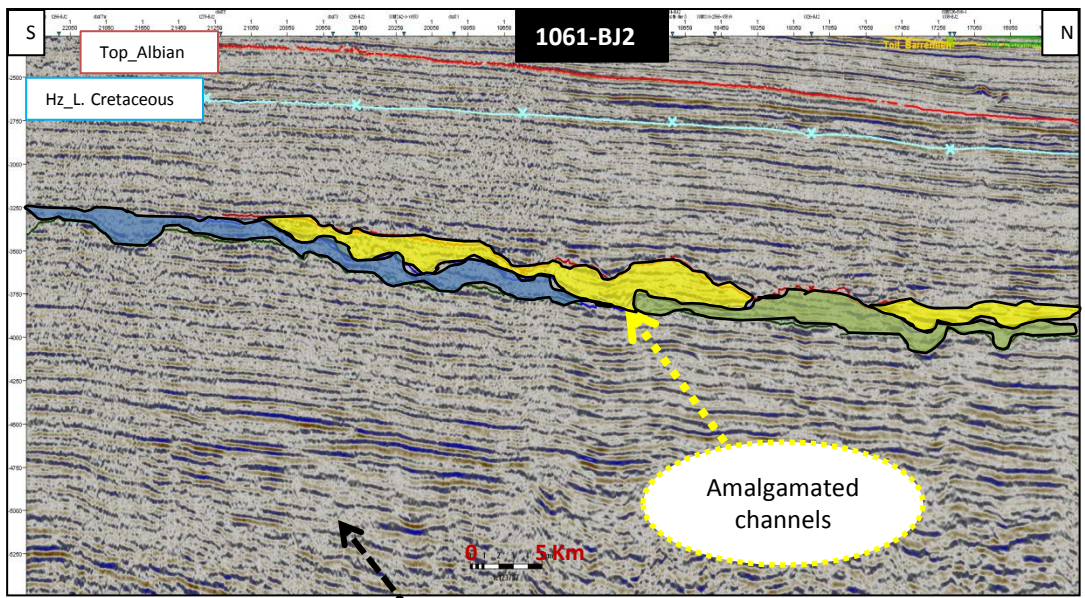
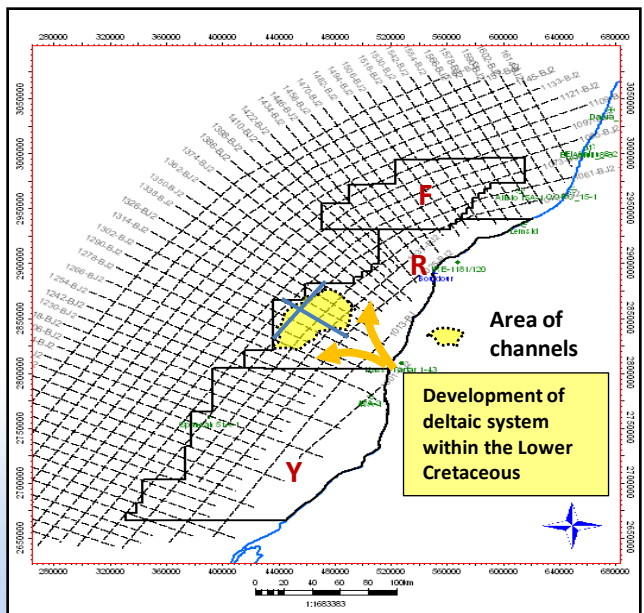
Exploration Results

800 Prospects & Leads in onshore and offshore Moroccan basins

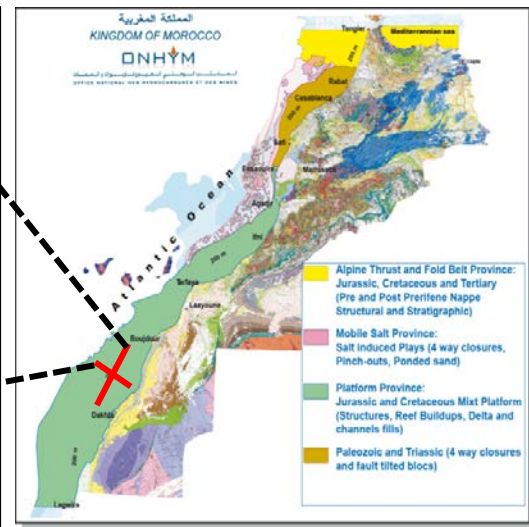


Example of play concepts Offshore Atlantic



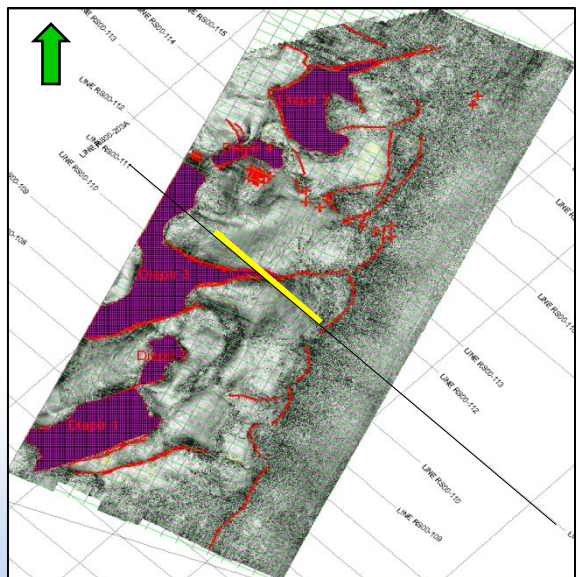


- **Traps :** Stratigraphic (Amalgamated Channels)
- **Reservoirs:** Lower Cretaceous sandstones
- **Source rocks:** Aptian and Jurassic
- **Seals:** Tertiary & Upper Cretaceous marls and shales

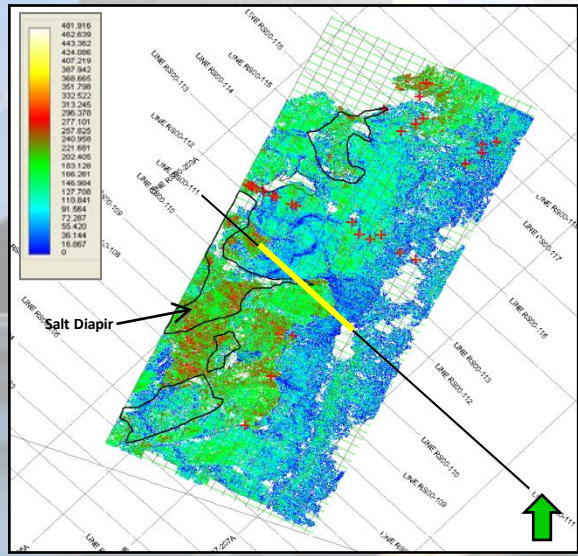


Safi Deep Offshore

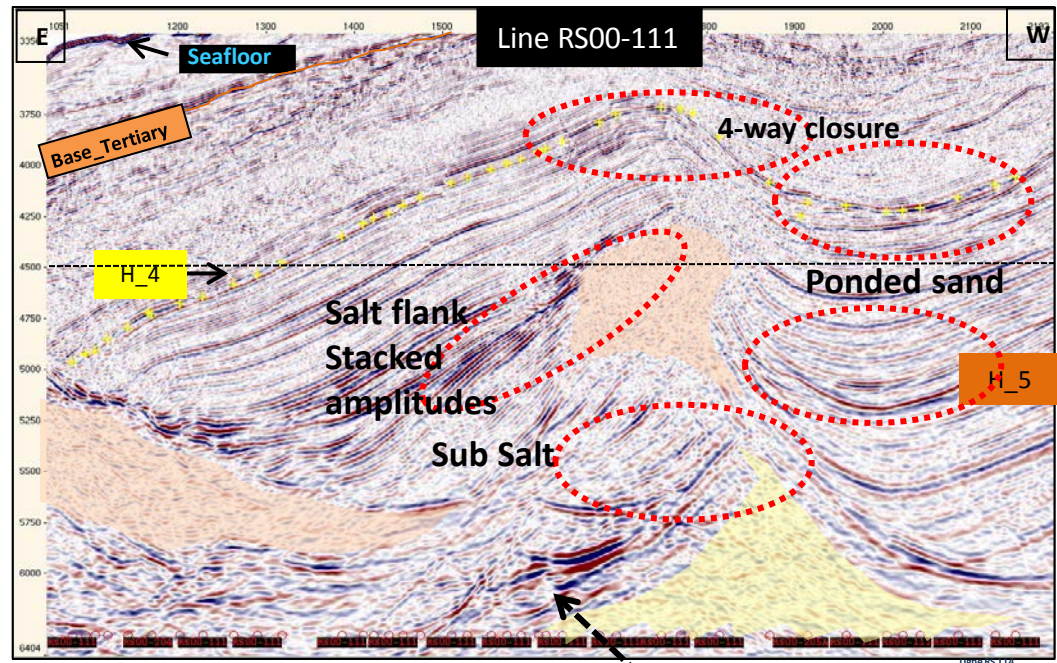
Lower Cretaceous Leads



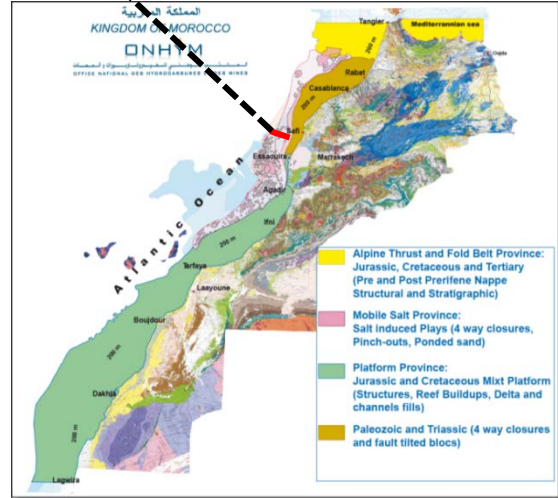
Time slice at 4500 ms of the « Dip of maximum similarity » attribute



«Shale indicator» attribute map extracted at the Lower Cretaceous (H_5)



- **Traps:**
 - Structures related to salt tectonics
 - Stratigraphic: pondered sand
- **Reservoirs:**
 - Lower Cretaceous sandstone turbidites
- **Source rocks:**
 - Aptian and Lower Jurassic (Toarcian)
- **Seals:**
 - Upper Cretaceous marls & shales

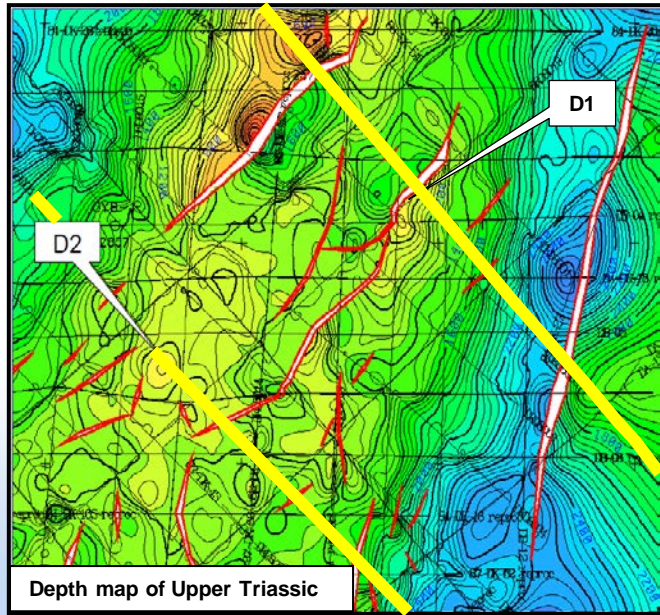


Example of play concepts Onshore



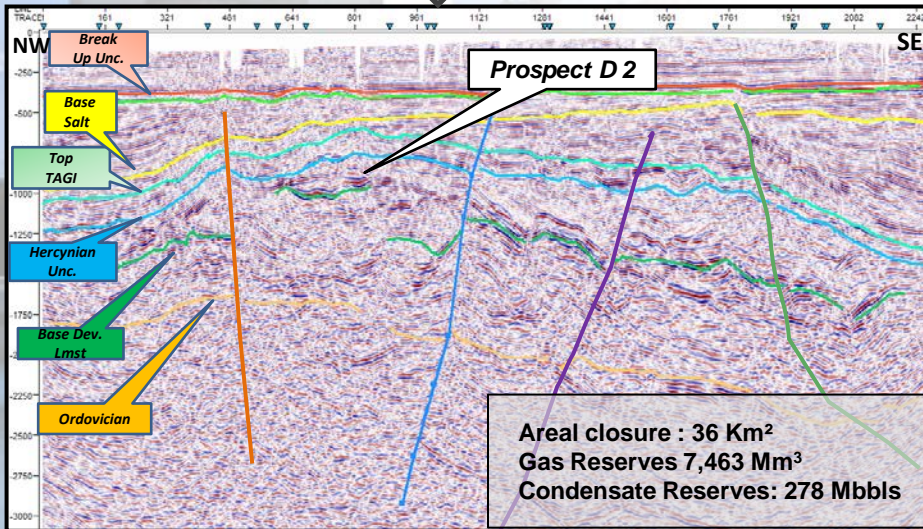
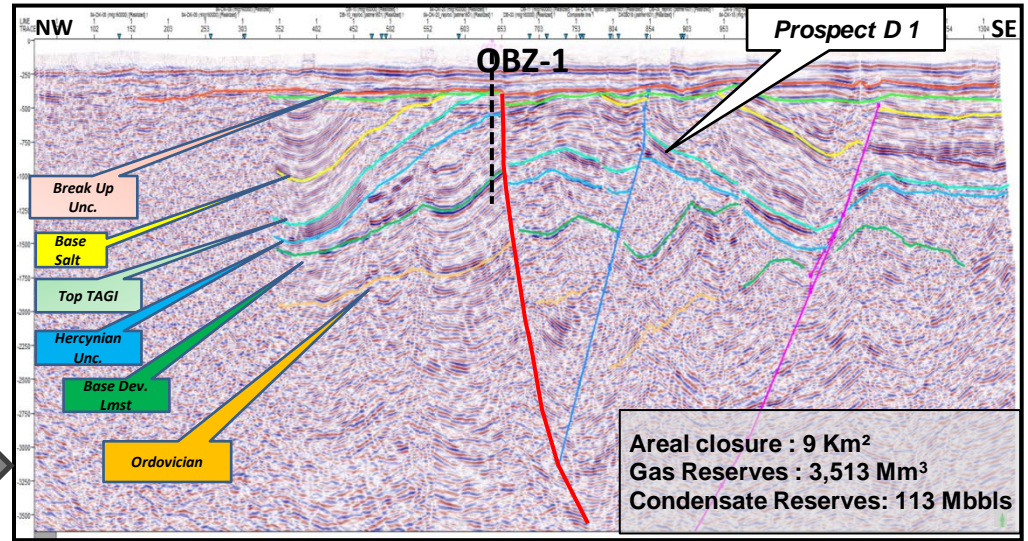
Abda Block

Triassic Prospects

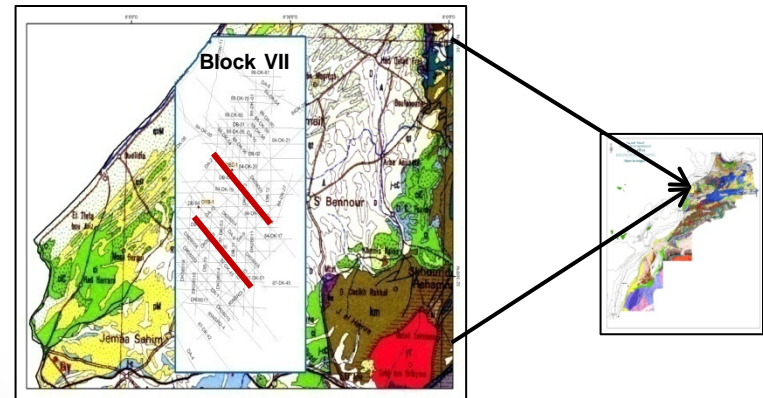


Depth map of Upper Triassic

Line DA-05, through the OBZ-1 Well to the D1 Structure

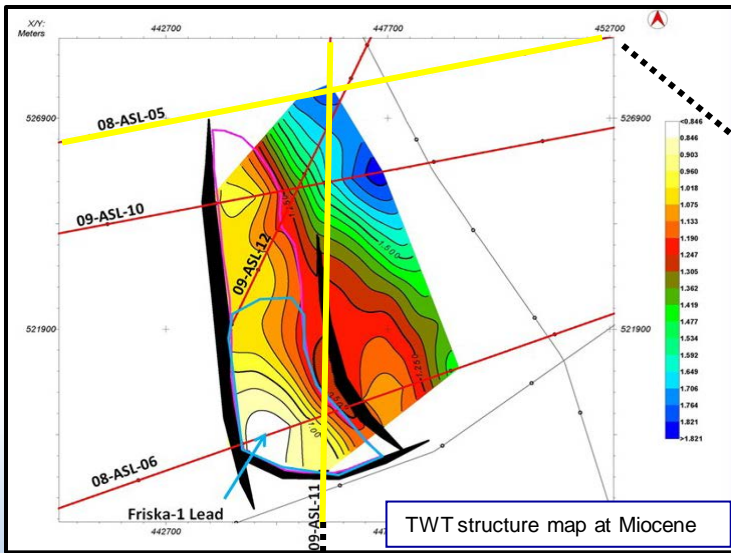


Line DK080006, through the D2 prospect

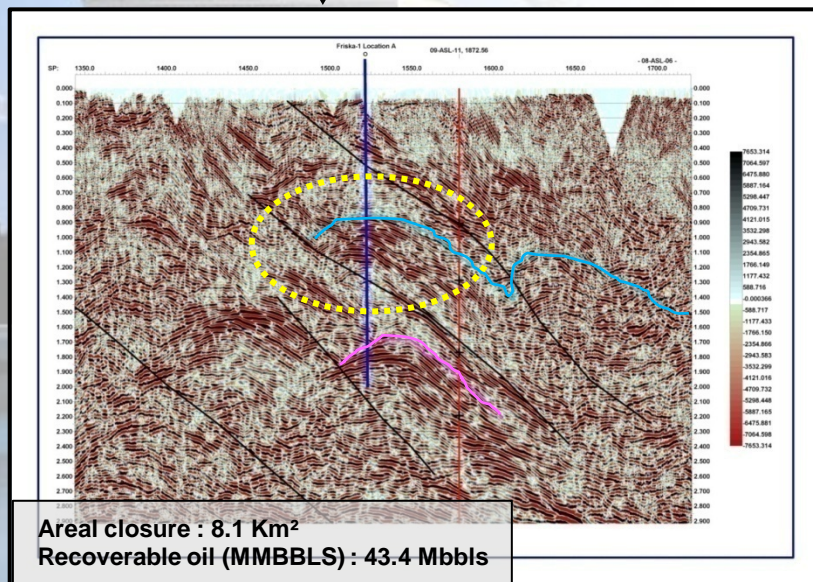


- **Traps** : Faulted block and accommodation anticlines
- **Reservoirs**: Triassic sandstones (TAGI)
- **Source rocks**: Silurian graptolic hot shale & Frasnian shale
- **Seals**: Triassic and Liassic interbedded shale & salt

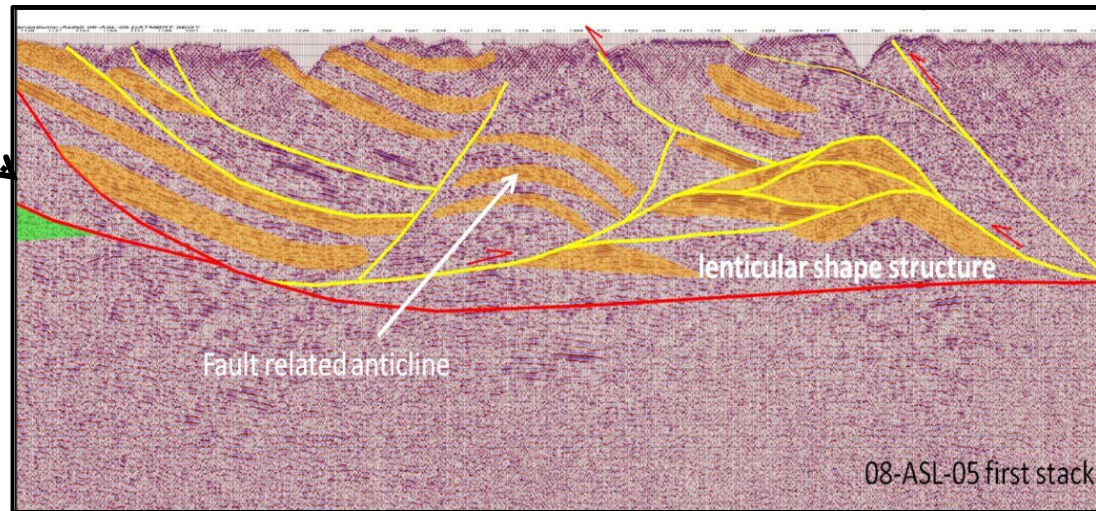




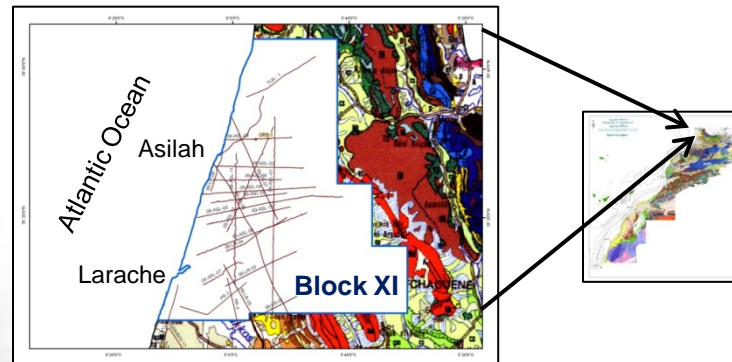
Friska-1 Lead



Line 09-ASL-11, through the Friska-1 Lead



Line 08-ASL-05, imbricated and folded Miocene play concept

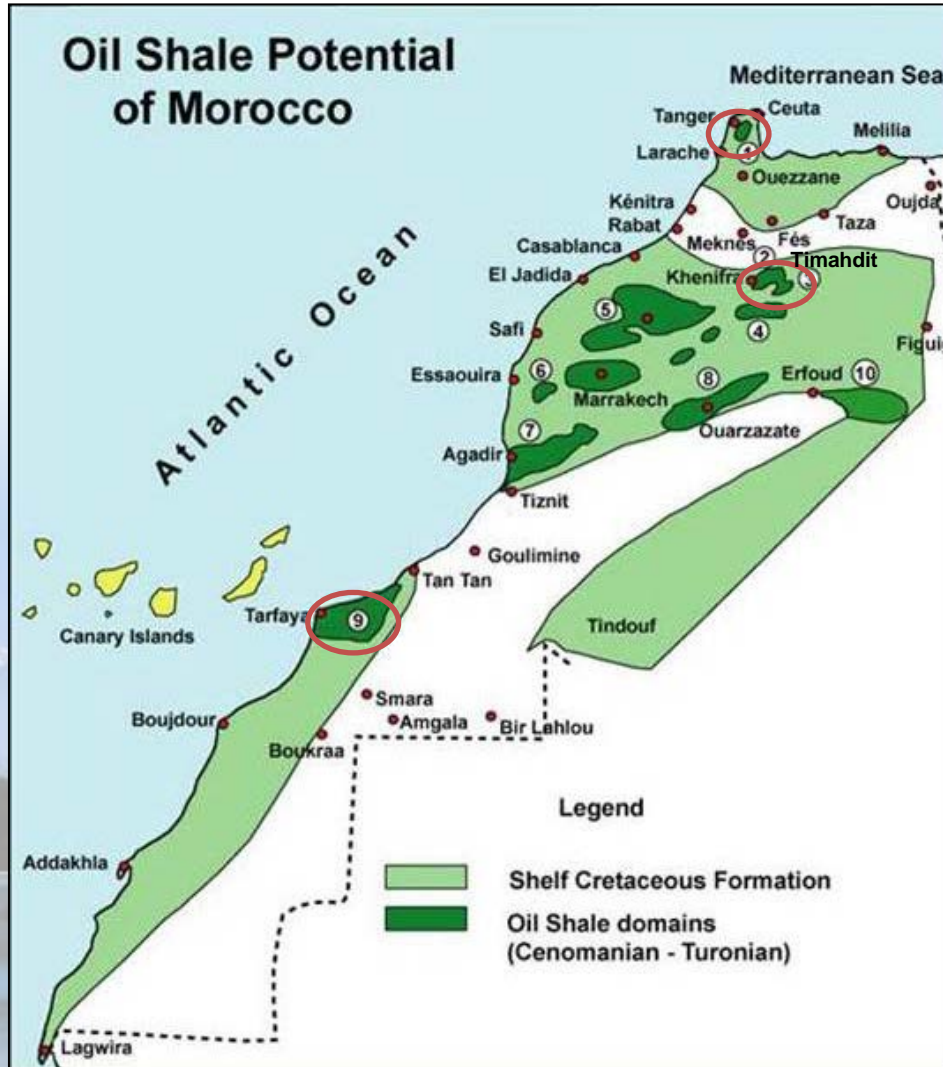


- **Traps** : Faulted anticline structures
- **Reservoirs**: Cretaceous & tertiary turbidites
- **Source rocks**: Cenomano-Turonian Shale
- **Seals**: Tertiary shale



Unconventional hydrocarbons: Shale potential

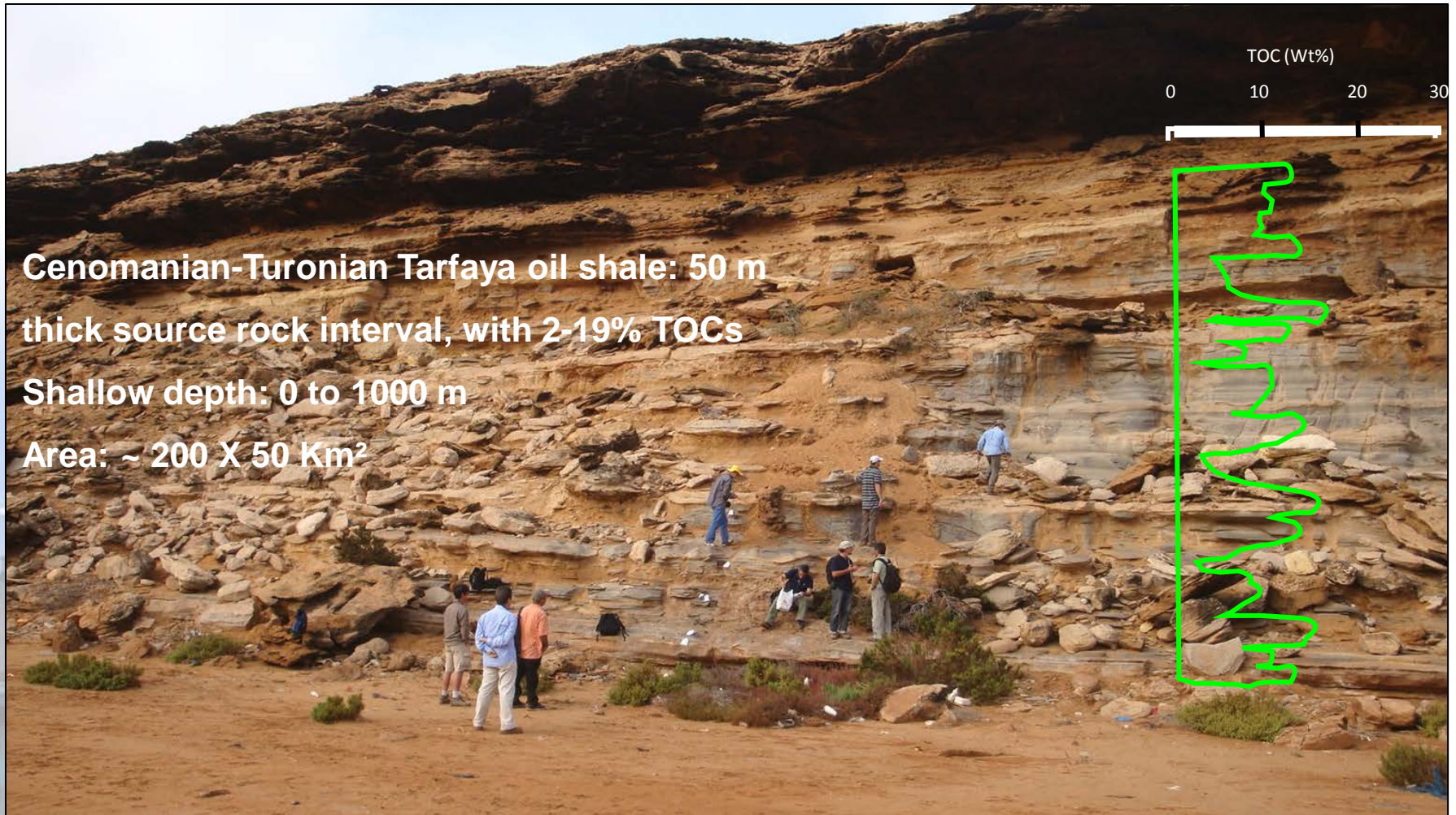
Oil shale potential in Morocco



- The efforts of research started during the Eighties. They are resumed by national and foreign partners in concordance with the Moroccan global strategy.
- Morocco has important oil reserves contained in the oil shales (approximately 50 billion barrels, Timahdit &Tarfaya).

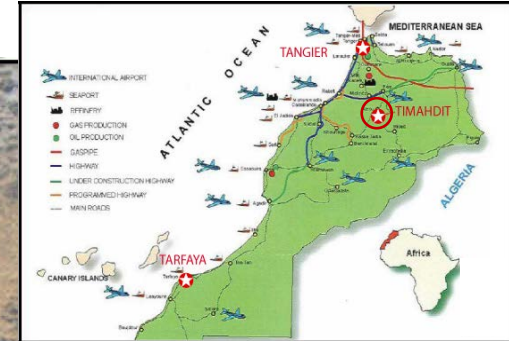
Oil shale potential in Morocco

Tarfaya onshore



Oil shale potential in Morocco

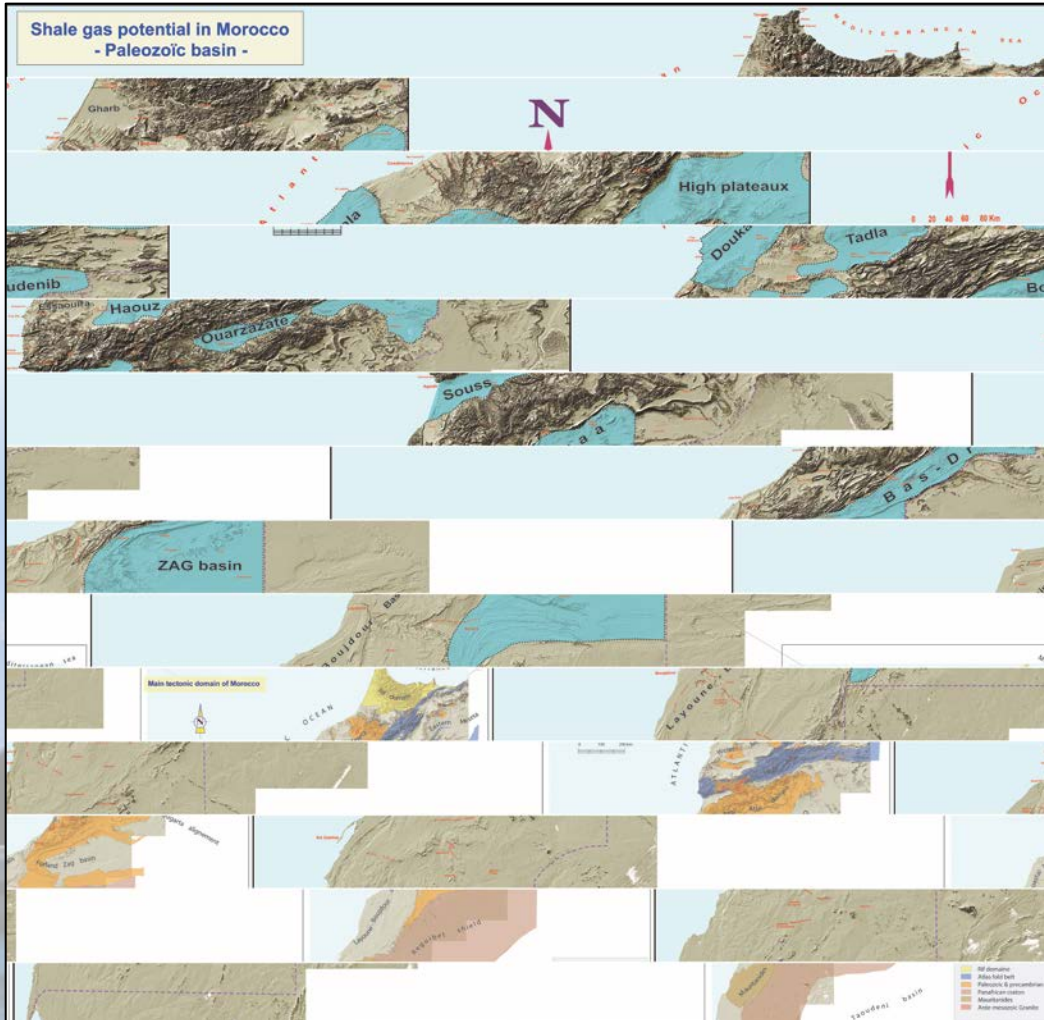
Timahdit section



**Timahdit Upper Cretaceous oil shale: Up to 250m thick
interval in an area of 900Km²**

Shale gas potential in Morocco

Paleozoic system

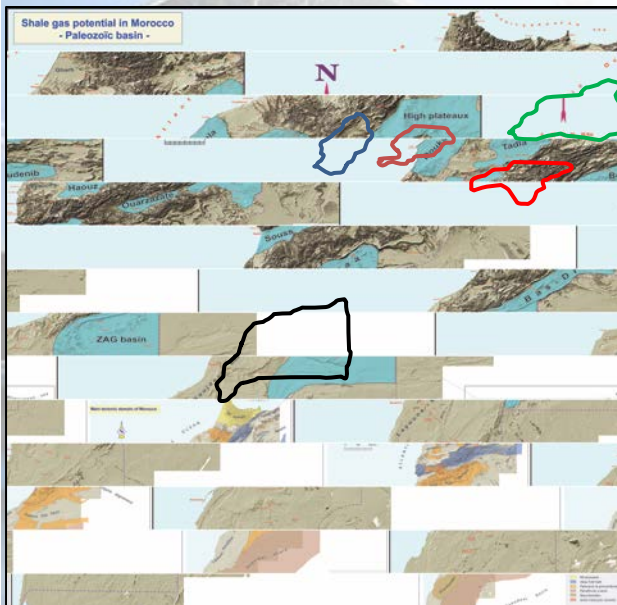


- First geological and geochemical appraisal of the Paleozoic depositional systems;
- Other basins worth a deep exploration work;
- The Mesozoic and Tertiary sediments have a good potential and should be considered for shale gas development plans.

Shale gas potential in Morocco

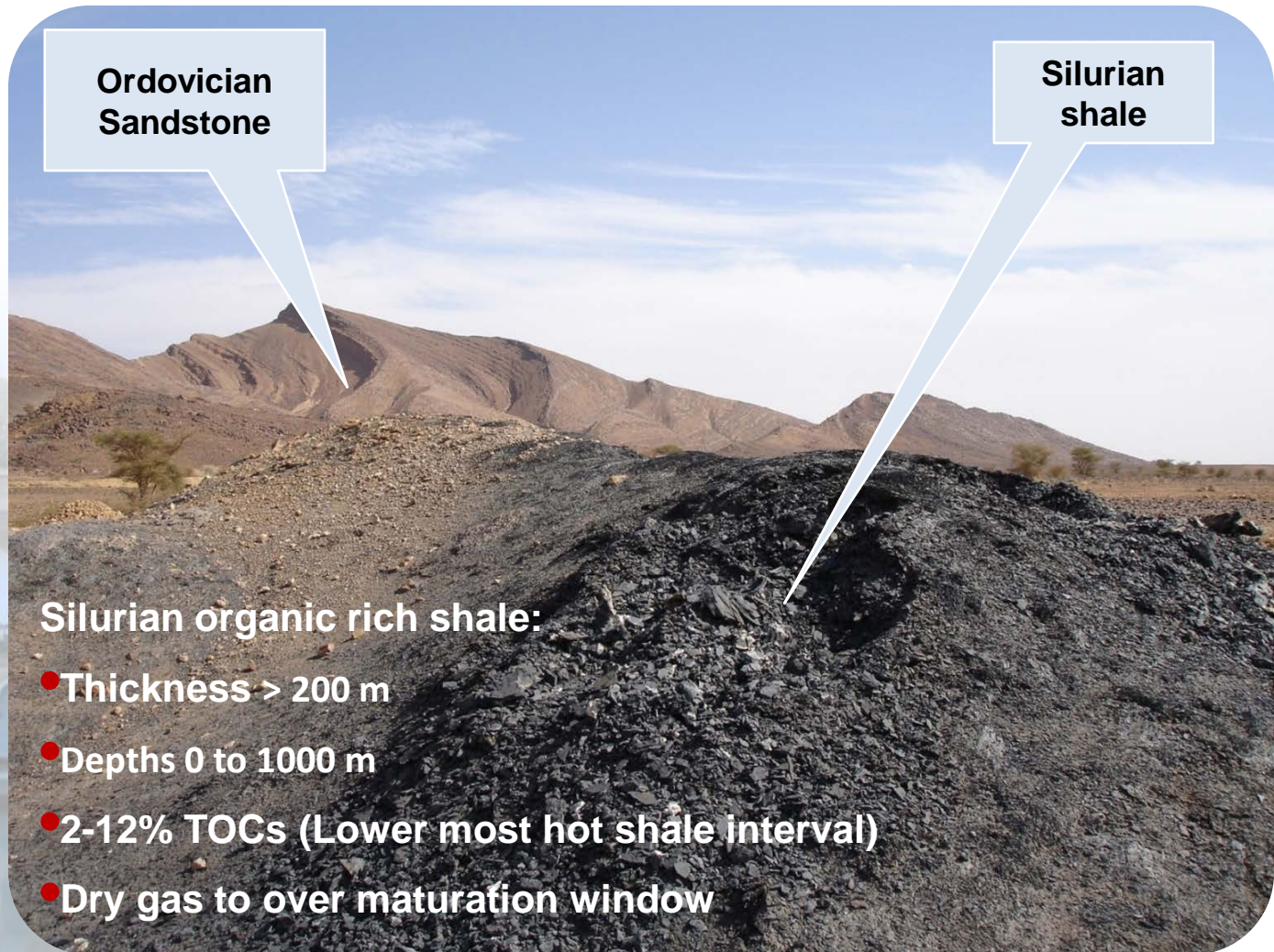
Paleozoic system

BASIN	AREA (Km ²)	FORMATION	TOC (%)
Boudenib	34 000	Carboniferous	1 – 1.45
		Devonian	1 – 1.3
		Silurian	1 – 3
Tadla	10 000	Carboniferous	1 – 2
		Devonian	1 – 5.3
		Silurian	1 – 12
Doukkala	8 000	Carboniferous	1 – 2
		Devonian	1 – 2.48
		Silurian	1 – 2.1
Zag	65 000	Devonian	1 – 2
		Silurian	1 – 2
High Plateaux	23 437	Carboniferous	1 – 1.6



Shale gas potential in Morocco

Eastern Anti-Atlas



Conclusions

- Moroccan sedimentary basins, both onshore and offshore, remain under-explored ;
- Exploration drilling activity, although limited, and outcrops have proven the presence of viable petroleum systems;
- New 3D seismic data have permitted to increase the rate of success and to delineate new prospects;
- Developed play concepts are ranging in age from Paleozoic to Tertiary, and are of different types;
- In term of unconventional hydrocarbons, Moroccan basins are believed to have a good potential and worth a deep exploration work.

Conclusions

Future exploration orientations

- Resumption of intensive exploration of the untested plays, both onshore and offshore, with new ideas;
- Reevaluation and upgrade of the previously indentified prospects and leads to go ahead for drilling;
- Acquisition of high quality seismic data and use of new reprocessing techniques and modelling to accurately assess and test the delineated plays and prospects;
- Intensive exploration programs to prove the unconventional hydrocarbon potential of the Moroccan basins.



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THANK YOU

Other material at boot

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