



Hydrocarbon Exploration in Morocco: Status & Perspectives



Outline

- Conventional HC Exploration;
 - Licensing Status;
 - Exploration ancient objectives and New ones
 - Perspectives;
- Objectives of the Remaining open blocs;
- Unconventional HC Exploration status
- Summary



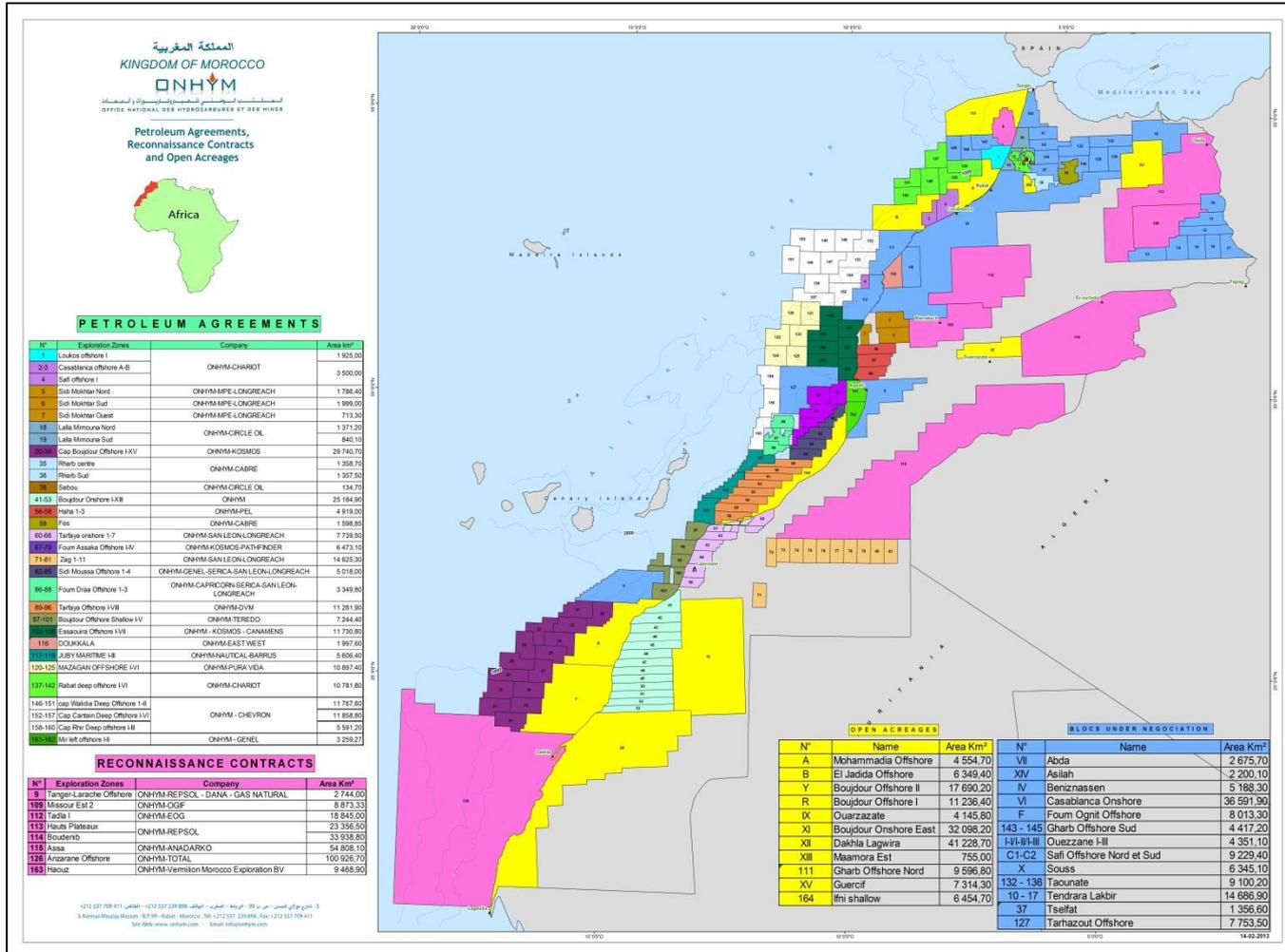


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Conv.H.C. Licensing Status

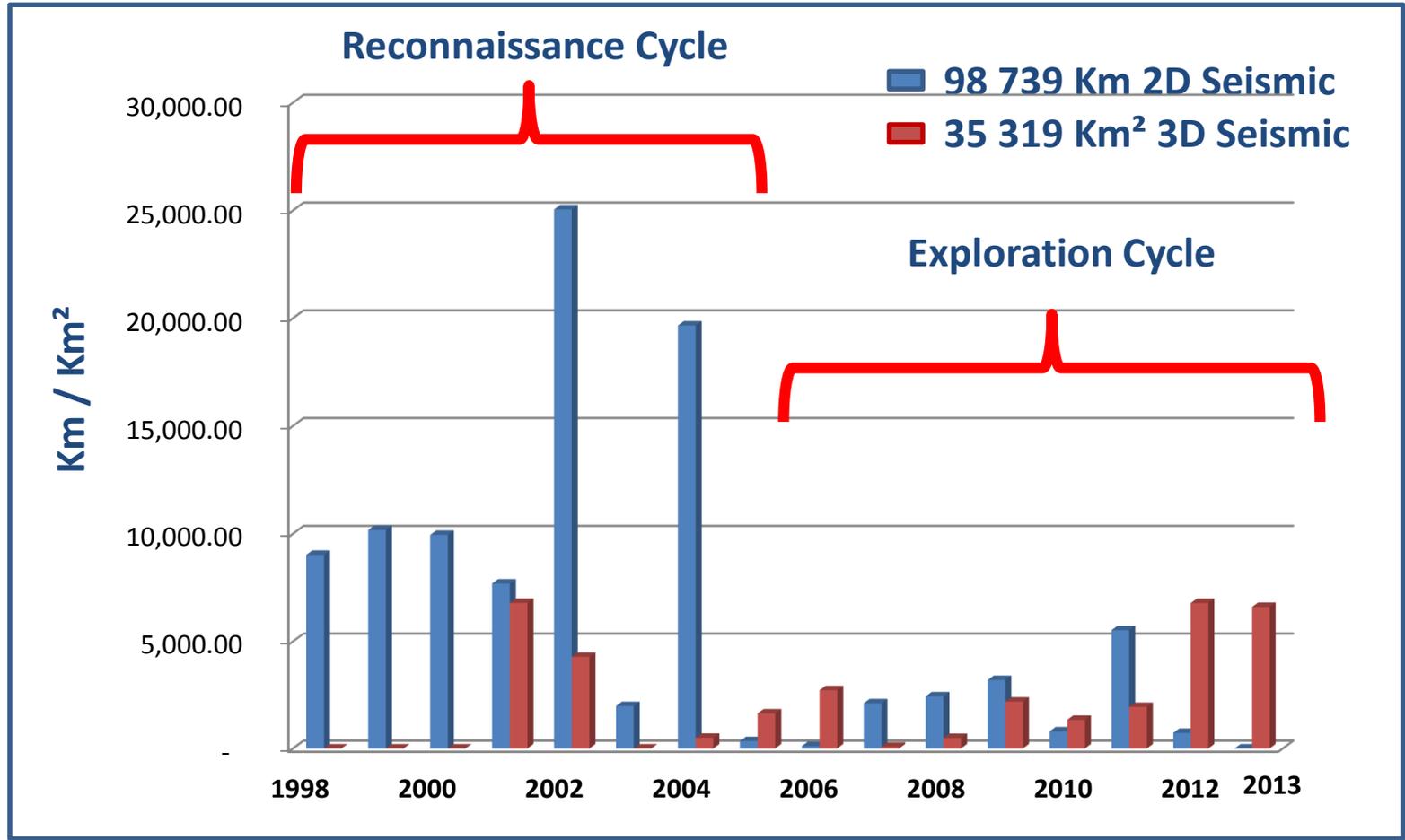


- Open acreage**
 - 06 blocks offshore
 - 05 blocks onshore
- Under negotiation**
 - 04 blocks offshore
 - 09 blocks onshore
- PA & RL**
 - 31 Petroleum Agreements offshore and onshore
 - 08 Reconnaissance Licenses (6 onshore and 2 offshore)



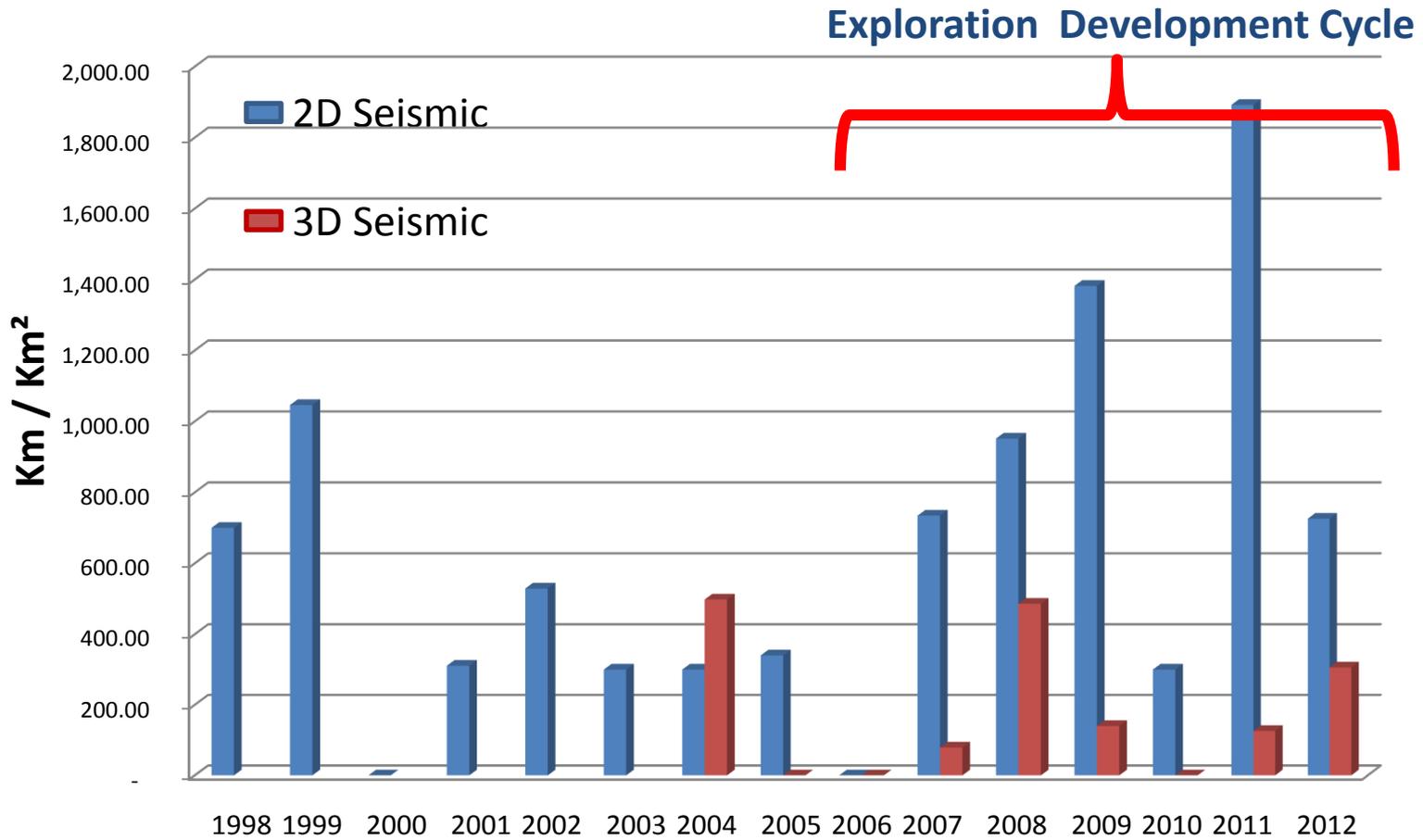
Conv. H.C. Licensing Status

2D and 3D Seismic Acquisitions offshore 1998 - 2013:



H.C. Licensing Status

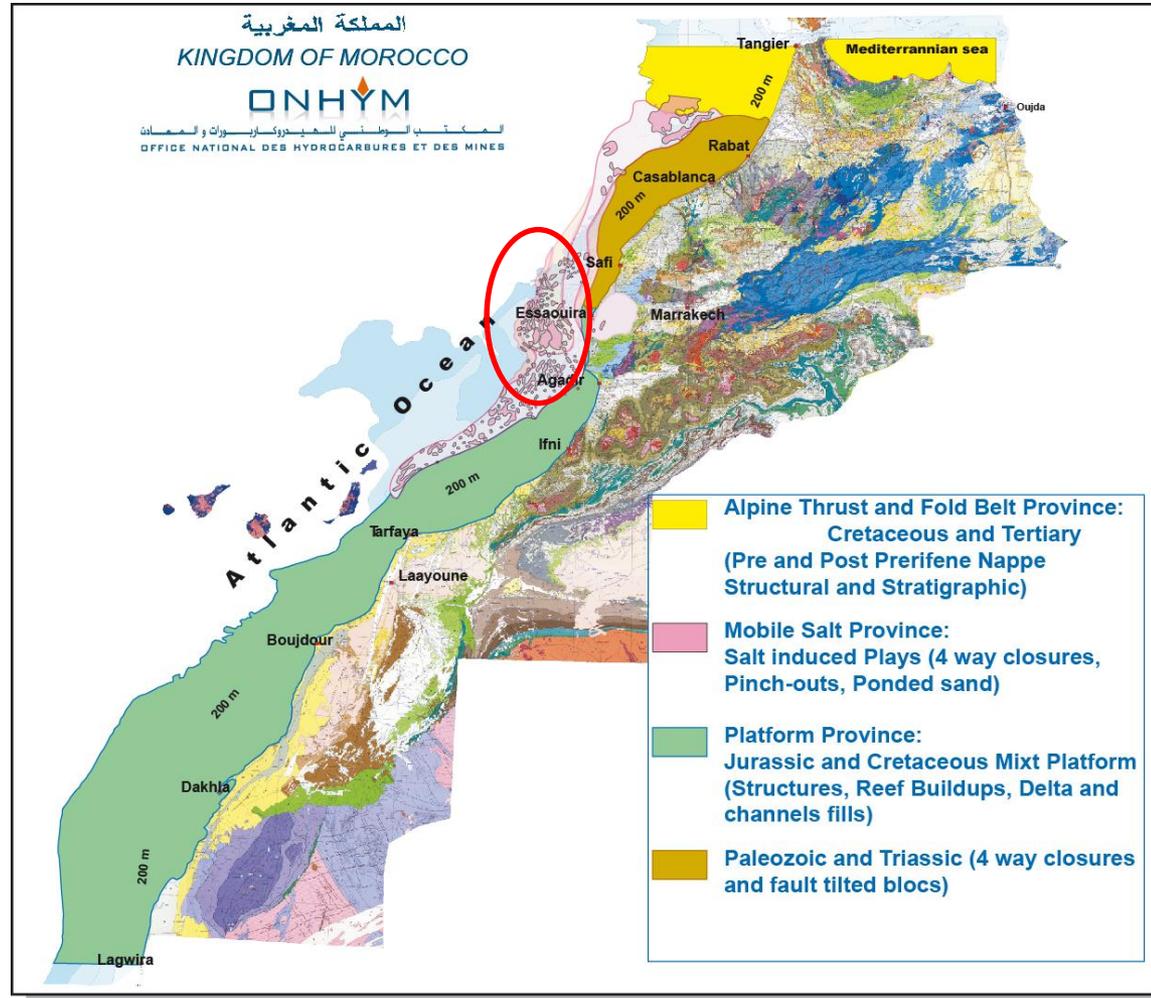
2D and 3D Seismic Acquisitions onshore since 1998:



Ancient Exploration Objectives

Ancient offshore exploration

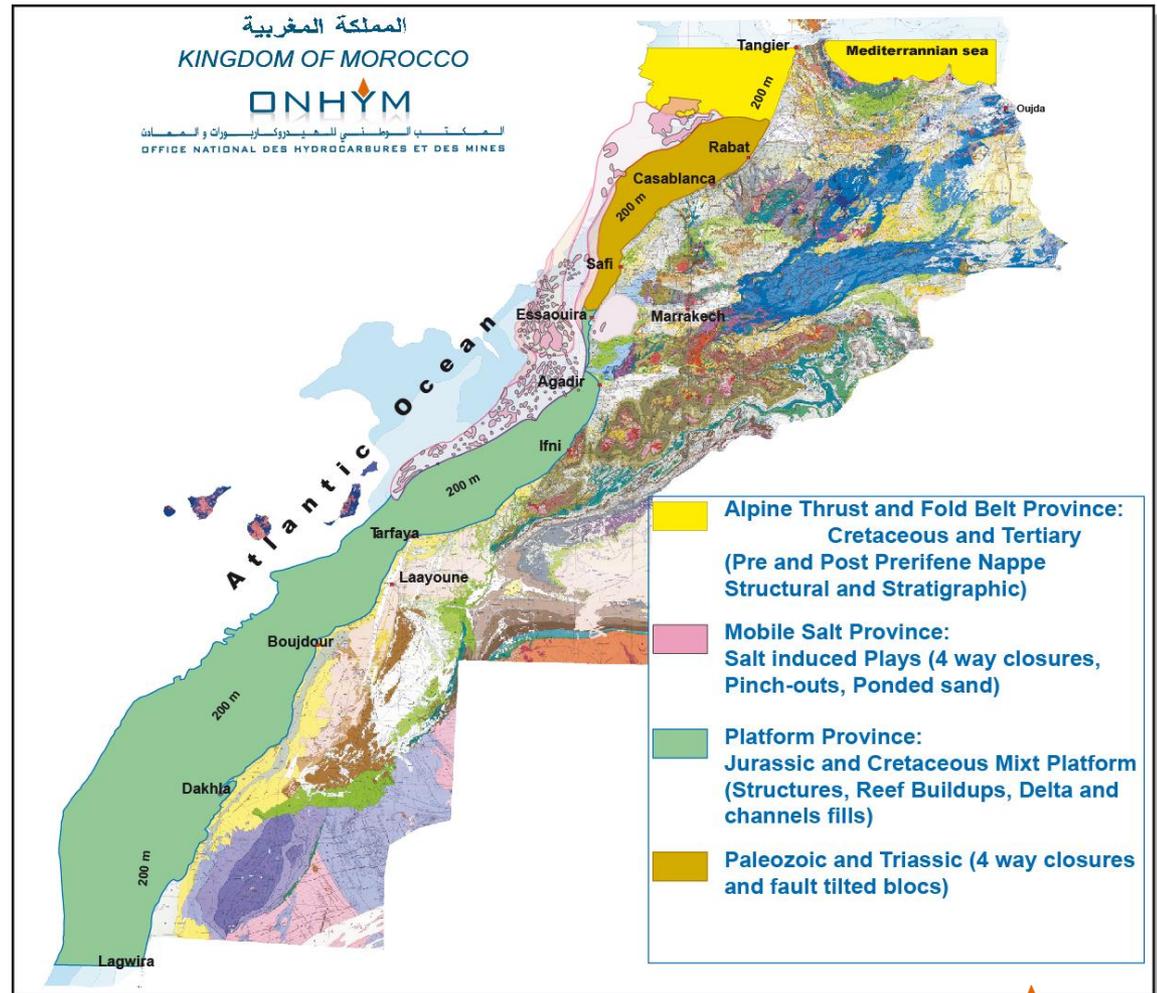
- Reconnaissance phase;
- Had set the bases for advanced exploration;
- Identified myriad of prospects and leads (Over 200);
- focused on one unique play,
 - Outboard of the central part of the salt province;
 - Salt related Targets;
 - Focused on one unique Source Rock/Reservoir pair (Cenomanian, Turonian).



Exploration Objectives: Offshore

Objectives in relation with structural provinces :

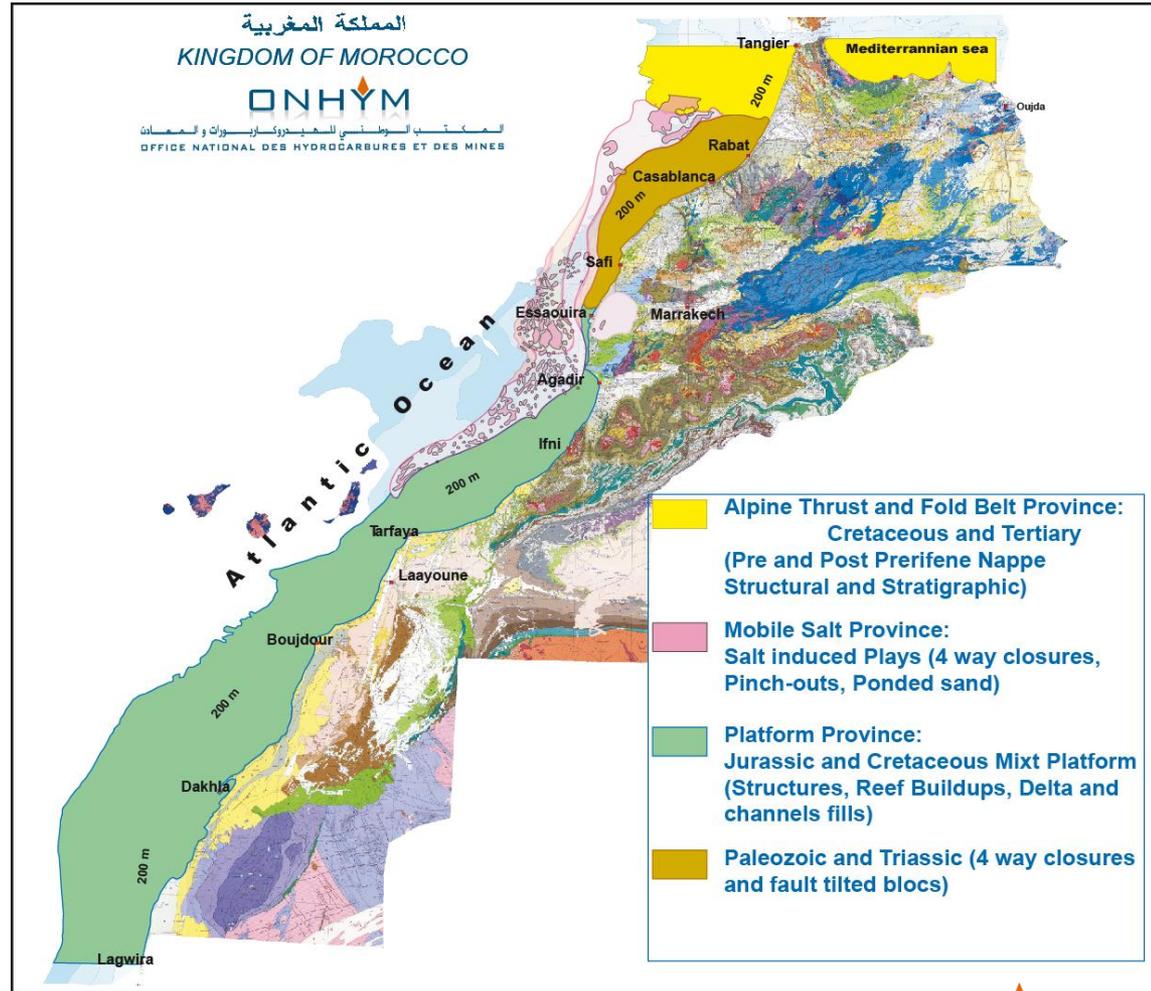
- Alpine thrust and fold belt province (Cretaceous and Tertiary)
- Northern Shallow Offshore Province (Paleozoic and Triassic)
- Mobile salt province (Jurassic, Cretaceous and Tertiary)
- Platform and Deep Offshore Province (Jurassic, Cretaceous and Tertiary)



(SR , RR) Pairs: Offshore

(Source Rocks , Reservoir Rocks) Proven Pairs:

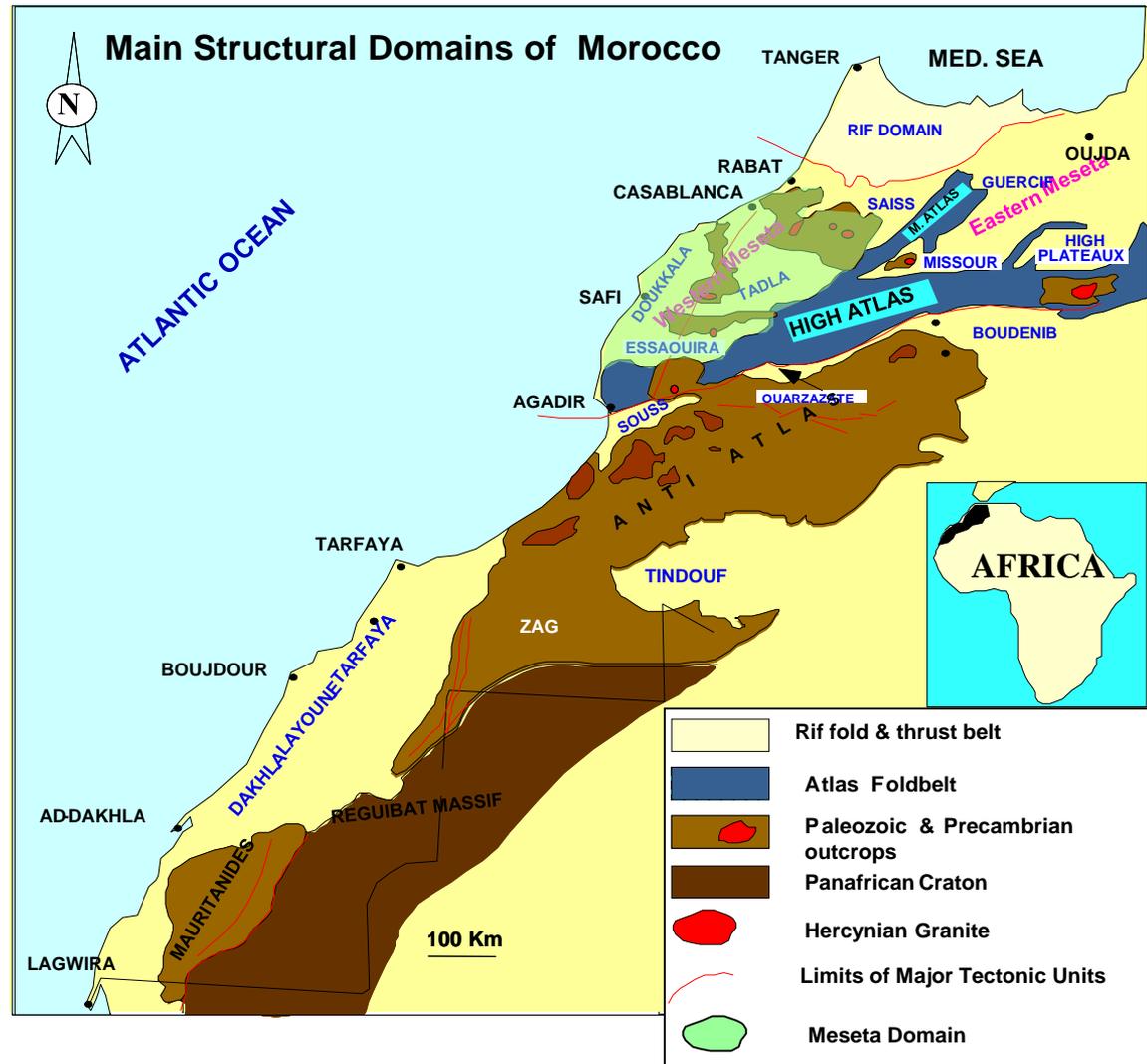
- Alpine thrust and fold belt
(Cenomanian, Tertiary)
- Northern Shallow Offshore
(Silurian, Devonian) and
(Silurian, Triassic)
- Mobile salt province
(Toarcian, Cretaceous /
Tertiary)
- Platform and Deep Offshore
Province
(Jurassic, Cretaceous /
Tertiary)



Exploration Objectives: Onshore

Objectives in relation with the Main structural domains :

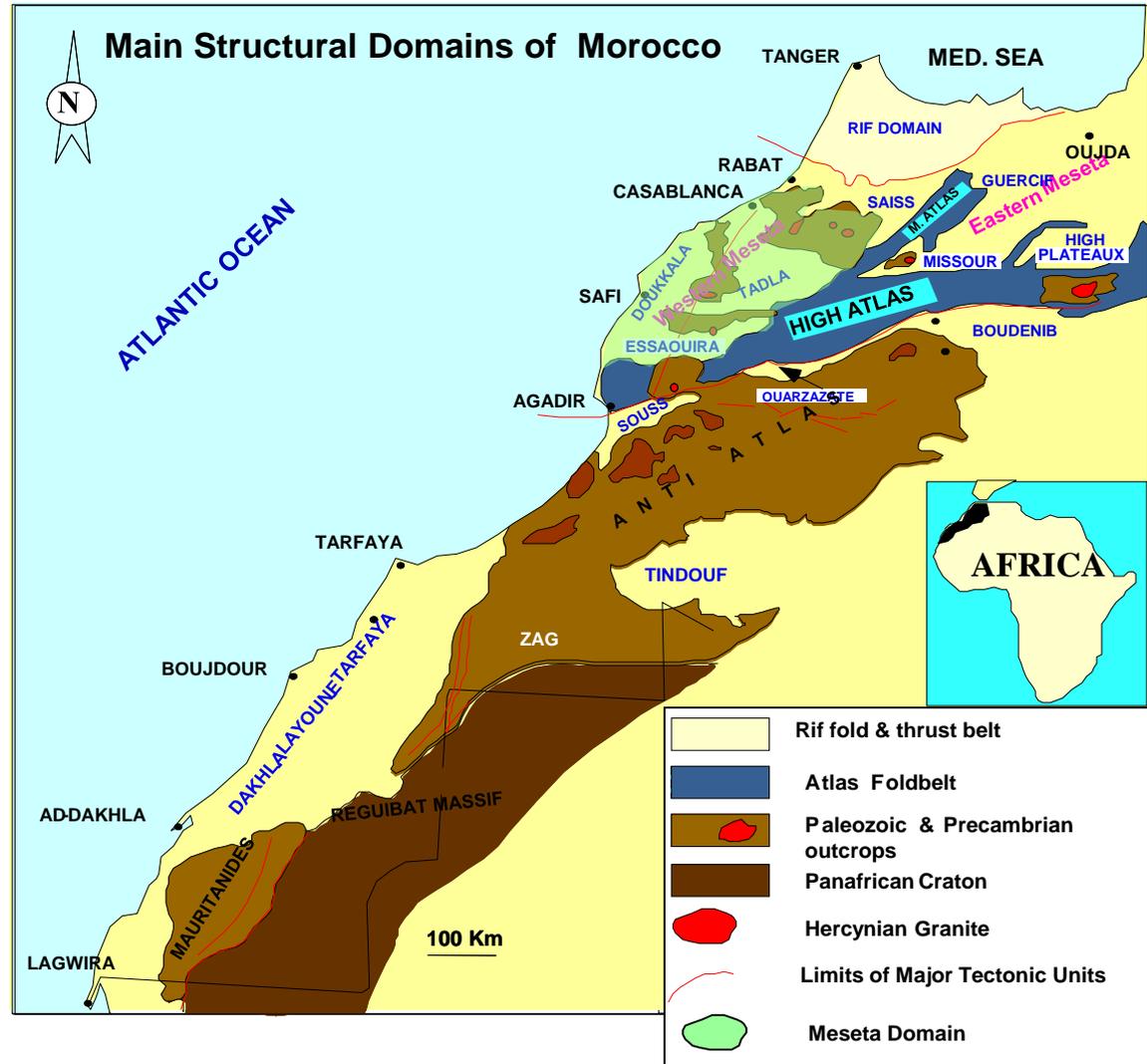
- The Rif fold and thrust belt (Mesozoic and Tertiary)
- The Meseta domain (Paleozoic, Triassic and Jurassic)
- The Atlas fold belt (Triassic and Jurassic)
- The Anti Atlas and Zag Hercynian domain (Paleozoic)
- The Saharian Coastal basins (Triassic, Jurassic, Cretaceous and Tertiary)



(SR , RR) Pairs: Onshore

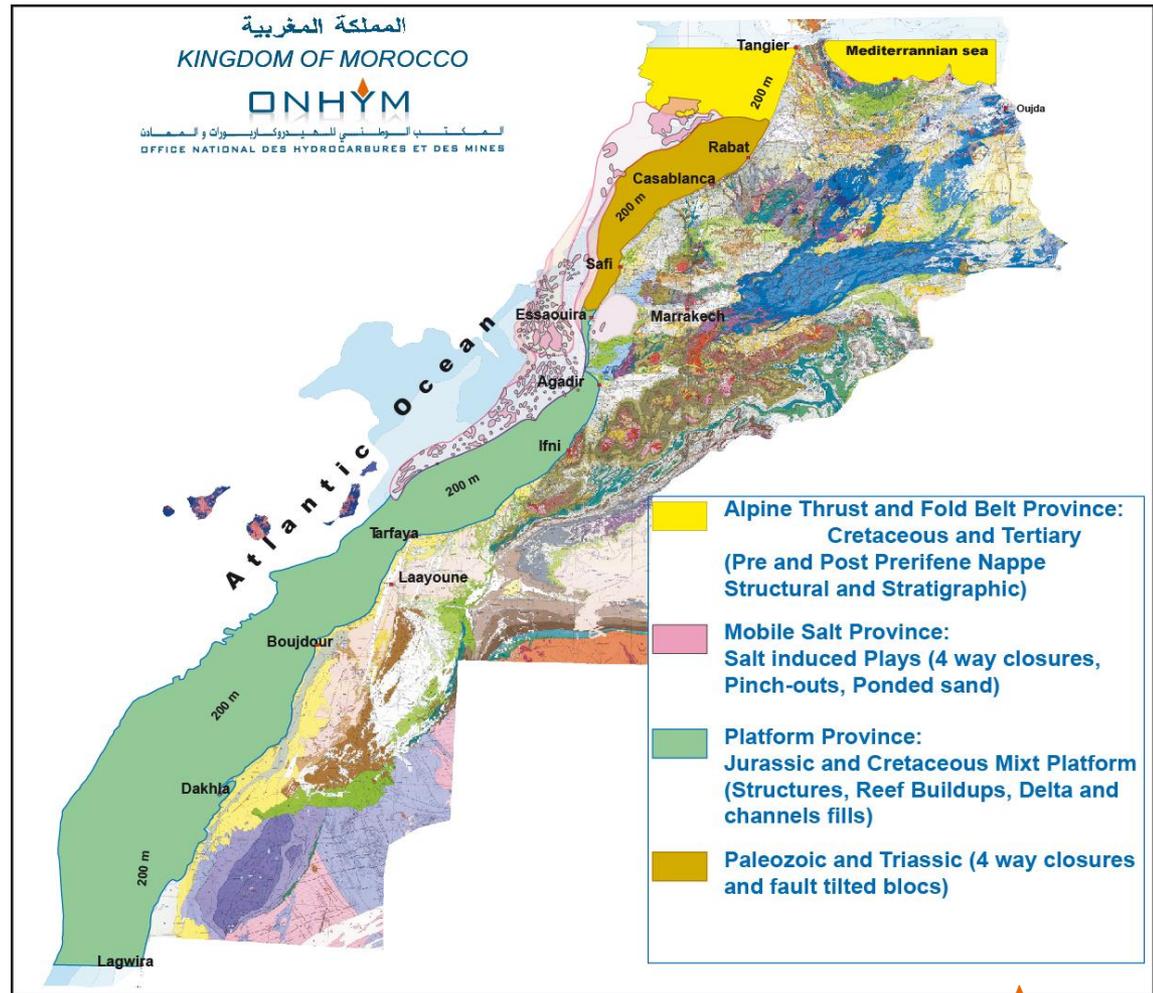
Source Rocks-Reservoir Rocks Proven Pairs

- The Rif fold and thrust belt
(Toarcian , Domairian)
(Cenomanian , Tertiary)
- The Meseta domain
(Silurian, Paleozoic)
(Silurian, Triassic)
(Oxfordian, Upper Jurassic)
- The Atlas fold belt
(Silurian, Triassic) and
(Toarcian, Jurassic)
- The Anti Atlas and Zag basin
(Silurian , Cambro Ordovician)
(Silurian, Devonian)
- The Saharian Coastal basins
(Triassic, Triassic)
(Toarcian, Jurassic)
(Cenomanian, Coniancian)



Perspectives

DRILLING





Outline

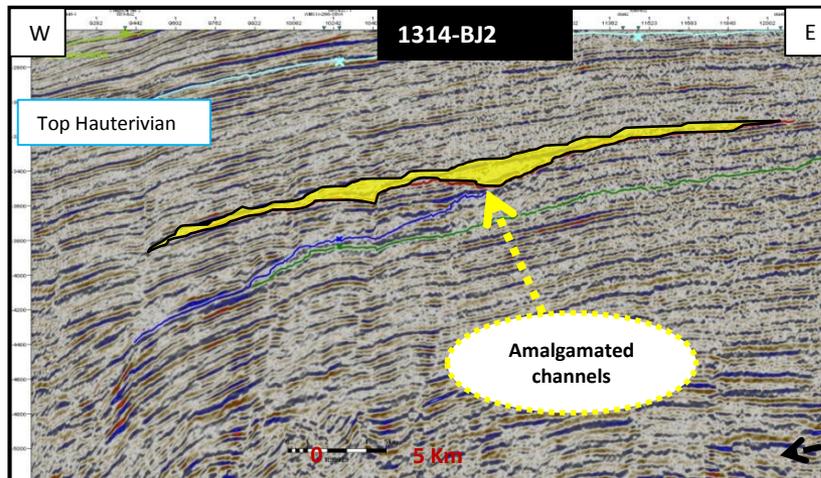
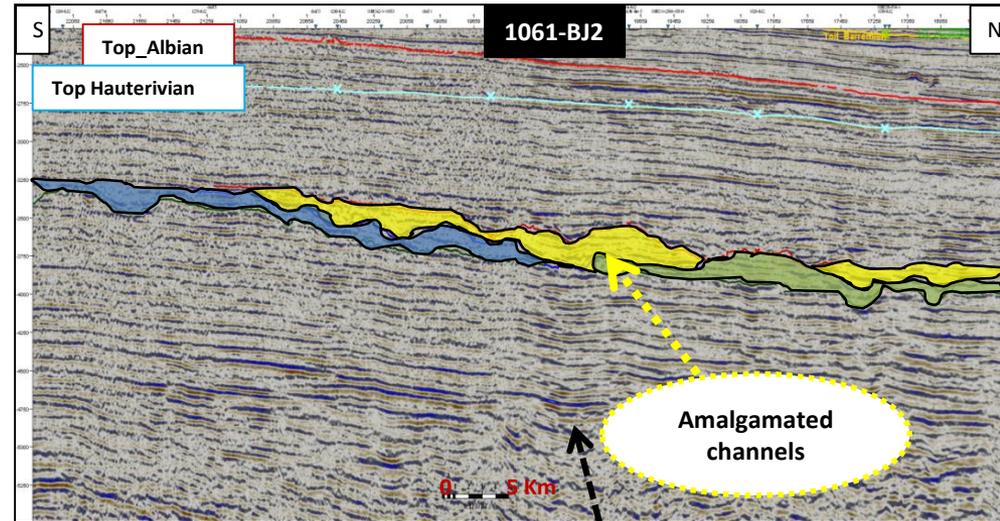
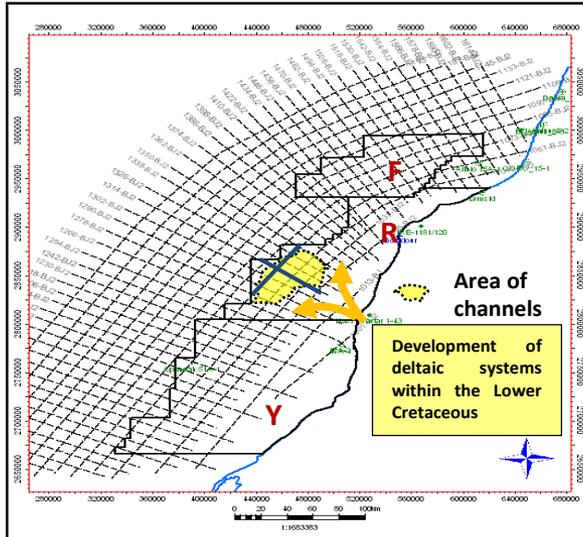
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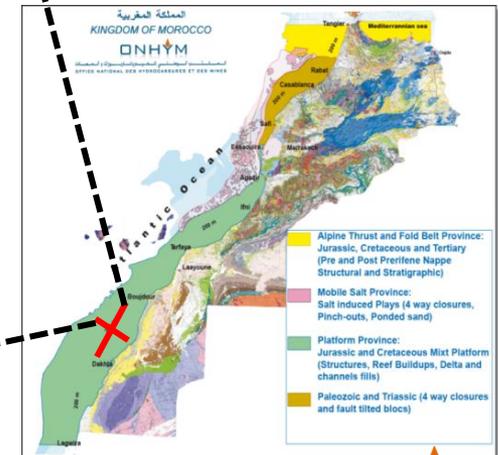
Conventional Hydrocarbon Resources

Offshore Basins

Example of play concepts : Lower Cretaceous lead in Offshore (Boujdour block)



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

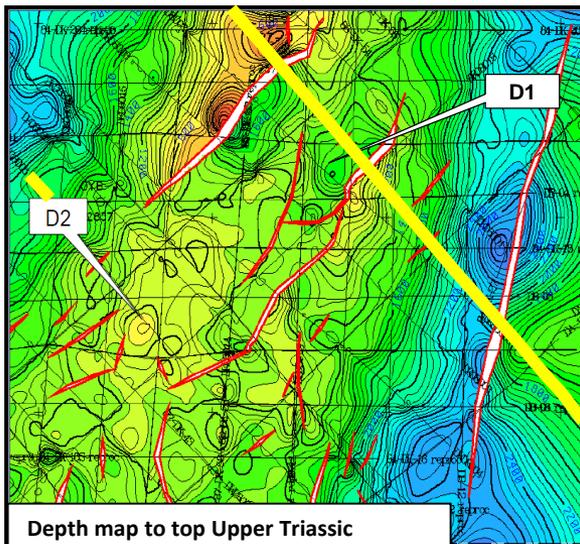
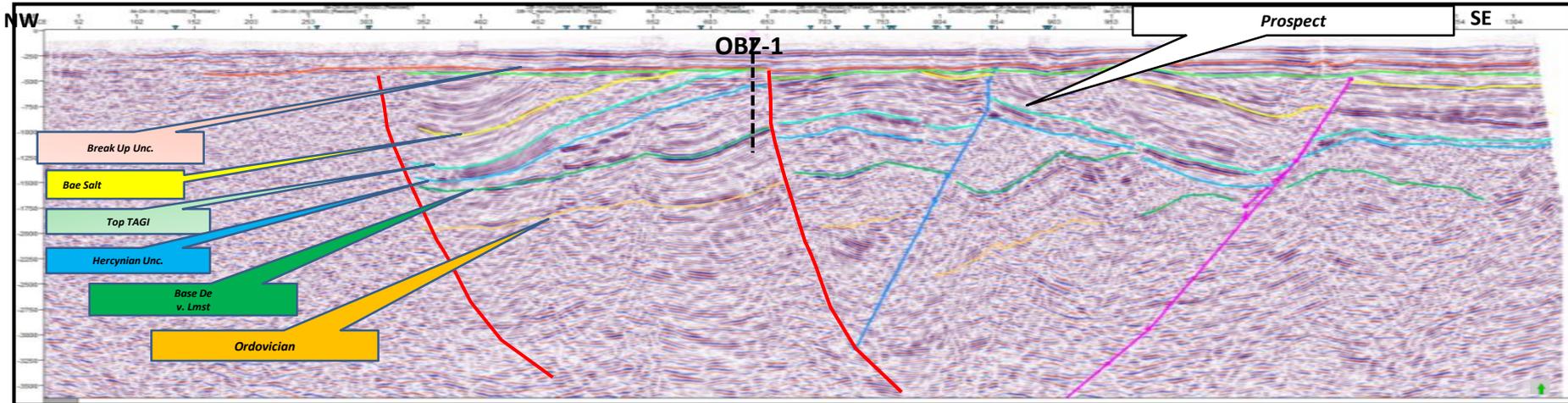


Conventional Hydrocarbon Resources

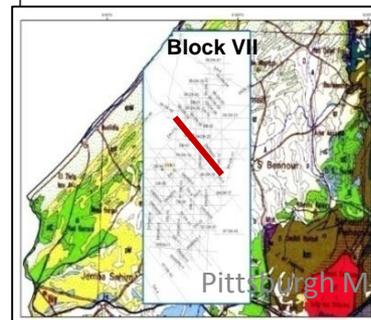
Onshore Basins

Example of play concepts : Triassic prospect in Onshore (Abda block)

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



- Traps : Faulted blocks and accommodation anticlines
- Reservoirs: Triassic sandstones (TAGI)
- Source rocks: Silurian hot shales & Frasnian shales
- Seals: Triassic and Liassic interbedded shales & salt





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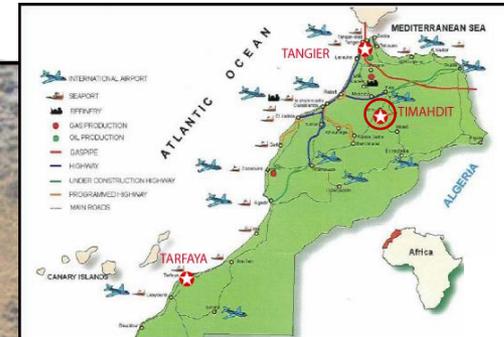
Unconventional Hydrocarbons: Oil Shale



- Oil - shale deposits have been identified at ten localities in Morocco (map), the most important of which are Upper Cretaceous . The two deposits that have been explored most extensively are the Timahdit and the Tarfaya deposits ;
- Morocco has important oil reserves contained in the oil shales (approximately 50 billion barrels, just in Timahdit & Tarfaya).

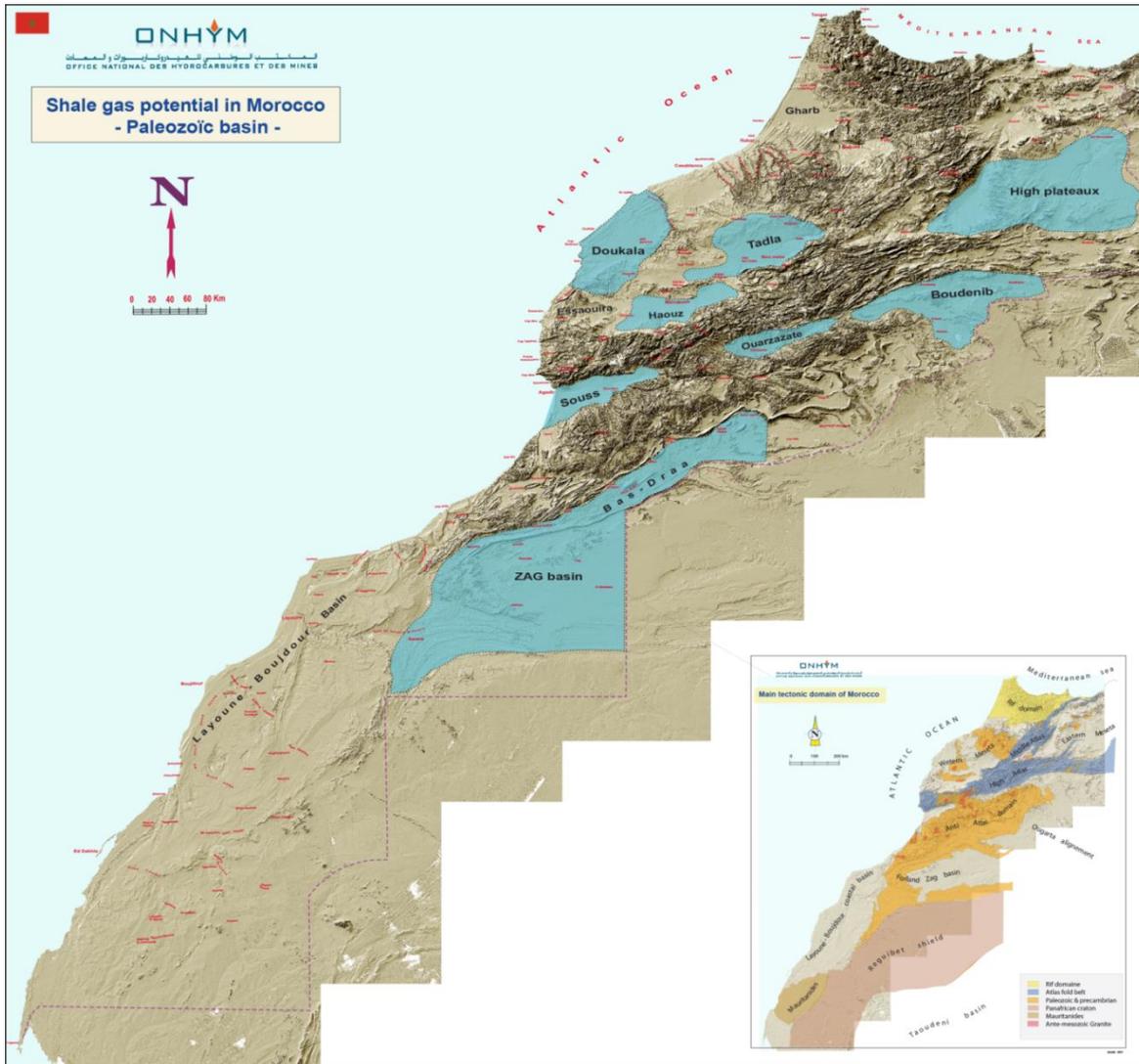
Unconventional Hydrocarbons: Oil Shale

Timahdit section



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

Unconventional Hydrocarbons: Shale Gas



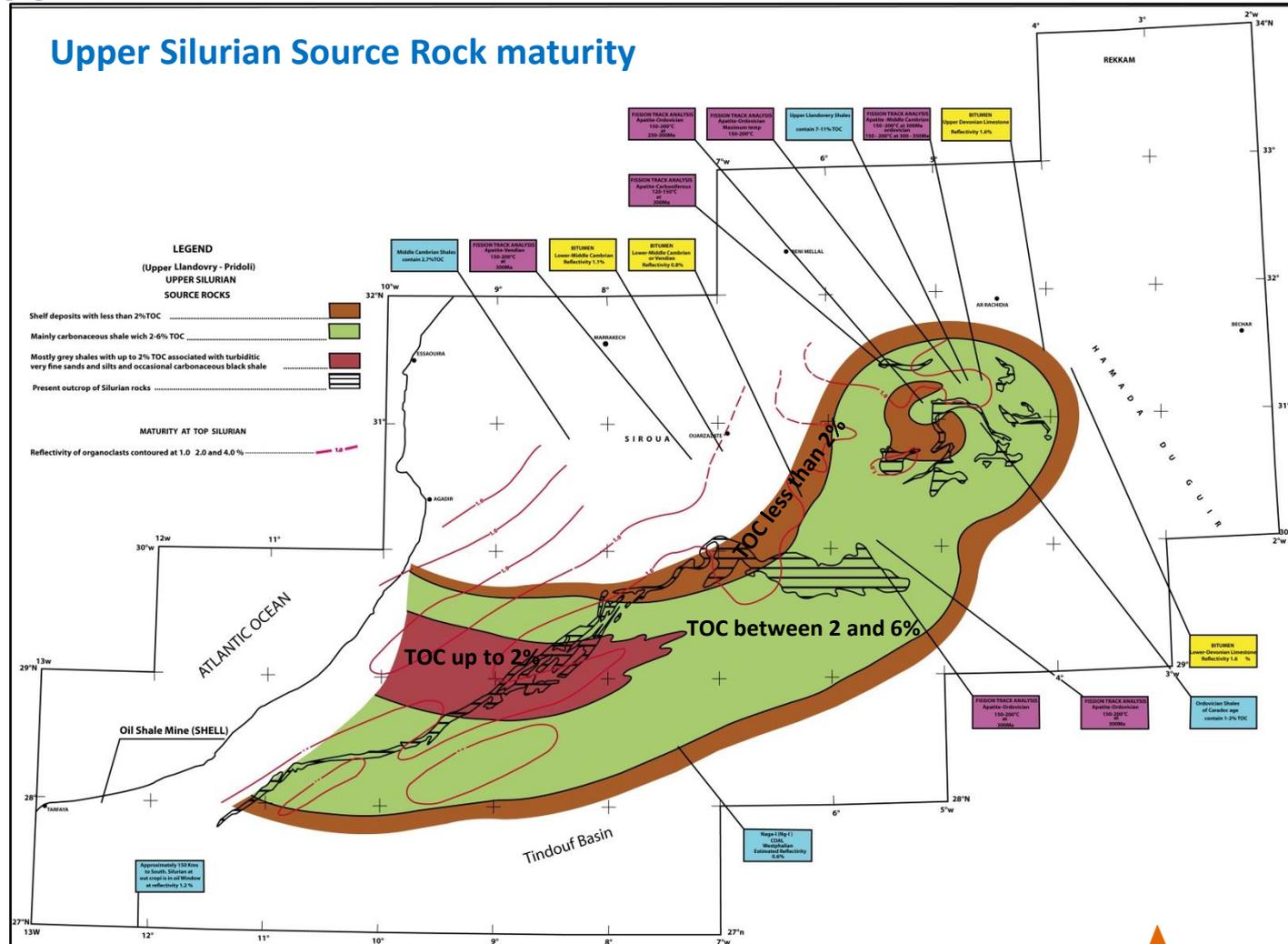
- First geological and geochemical appraisal of the Paleozoic depositional systems ;
- Other basins worth a deep exploration work ;
- The Mesozoic and Tertiary sediments have a good potential and should be considered for future shale gas development plans.

Unconventional Hydrocarbons: Shale Gas

Paleozoic system

Three potential formation intervals :

- Carboniferous
TOC 1-2 %;
- Devonian
TOC 1-5.3 %;
- Silurian
TOC 1-12 %;





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Summary

- Between 1998 and 2005, ancient Hydrocarbon exploration, in the Moroccan offshore have set, the bases for advanced exploration in frontier areas;
- It was focused one unique play;
- Exploration drilling activity, although limited, have contributed to the understanding Petroleum Systems ;
- Present day exploration is looking at plays of different types, ranging in age from Paleozoic to Tertiary and associated with different proven (SR,RR) pairs;
- In terms of unconventional hydrocarbons, preliminary studies indicate that the Moroccan basins have a good potential and are worth to be explored in depth.

Summary

Future exploration orientations

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



Thank you

Pittsburgh May, 2013

