EXPLORATION PLAYS IDENTIFIED OFFSHORE CUBA IN 24 LICENSE BLOCKS.

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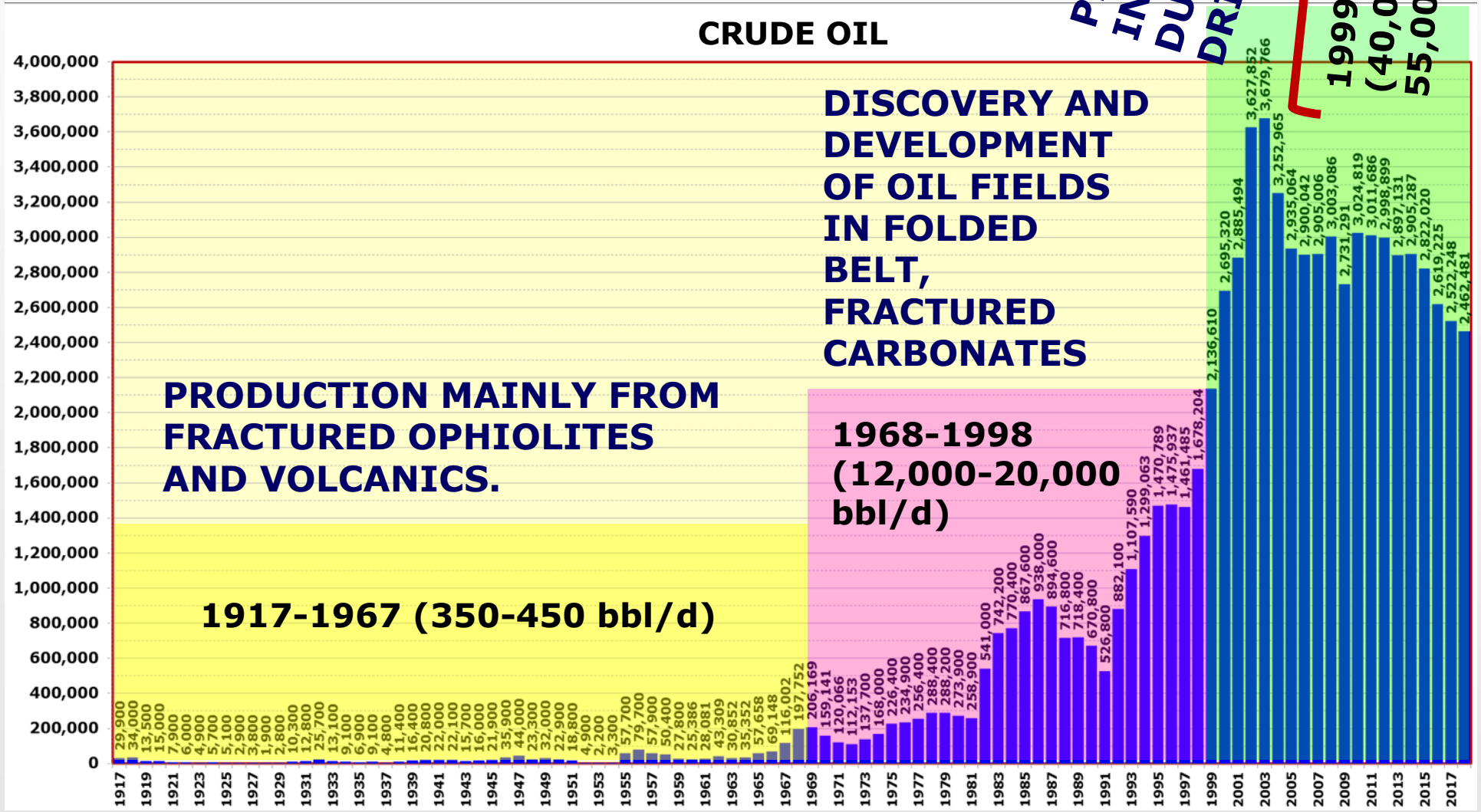
AGENDA:

1. UPDATE OF CUBAN OIL AND GAS PRODUCTION.
2. PETROLEUM SYSTEMS AND PLAY TYPES.
3. GENERAL CHARACTERISTICS OF BIDDING BLOCKS.
4. RESOURCE AND RISK ASSESSMENT.

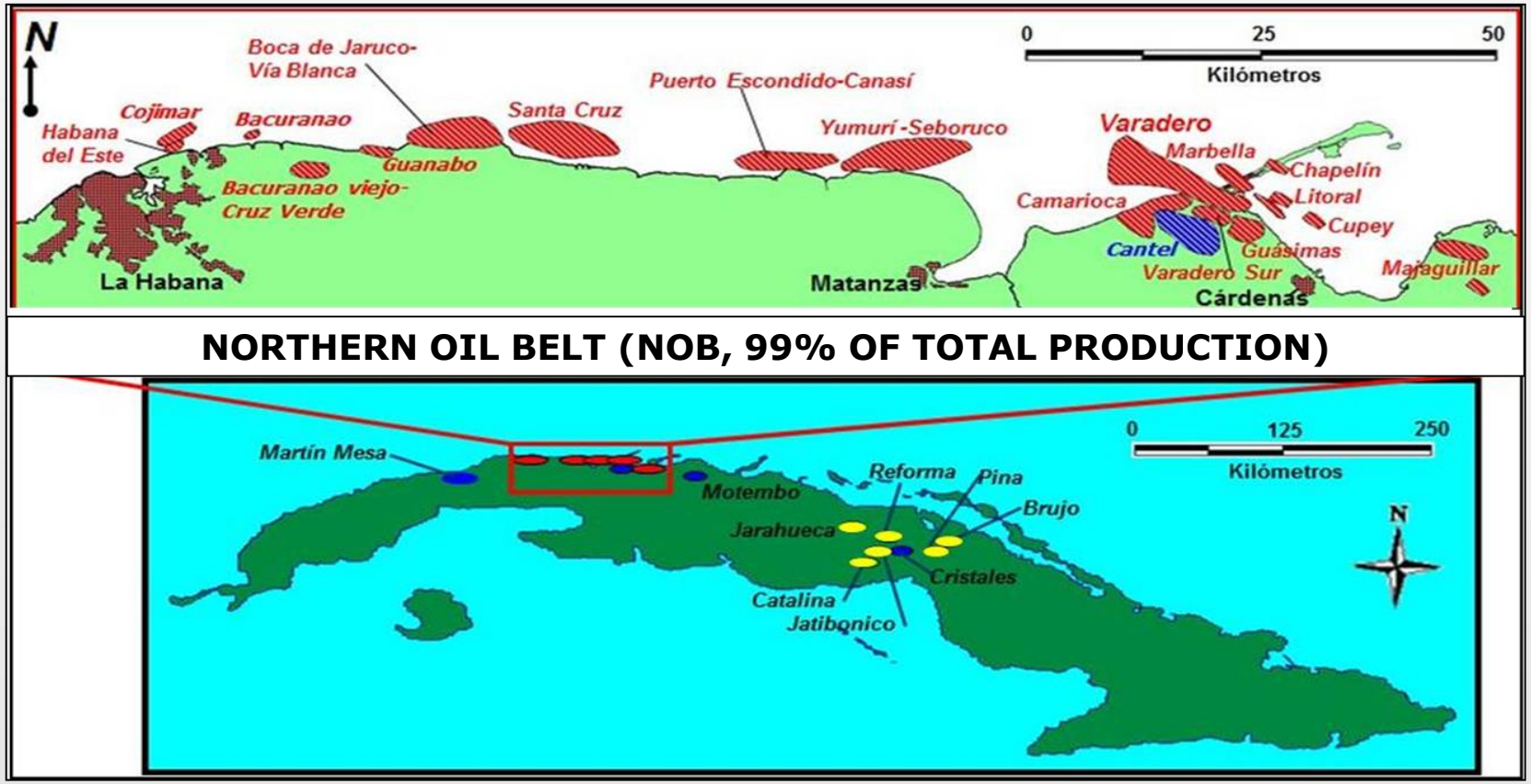
1. PRESENT DAY SITUATION OF CUBAN OIL & GAS PRODUCTION…….volumes and milestones.

OIL PRODUCTION IN 101 YEARS



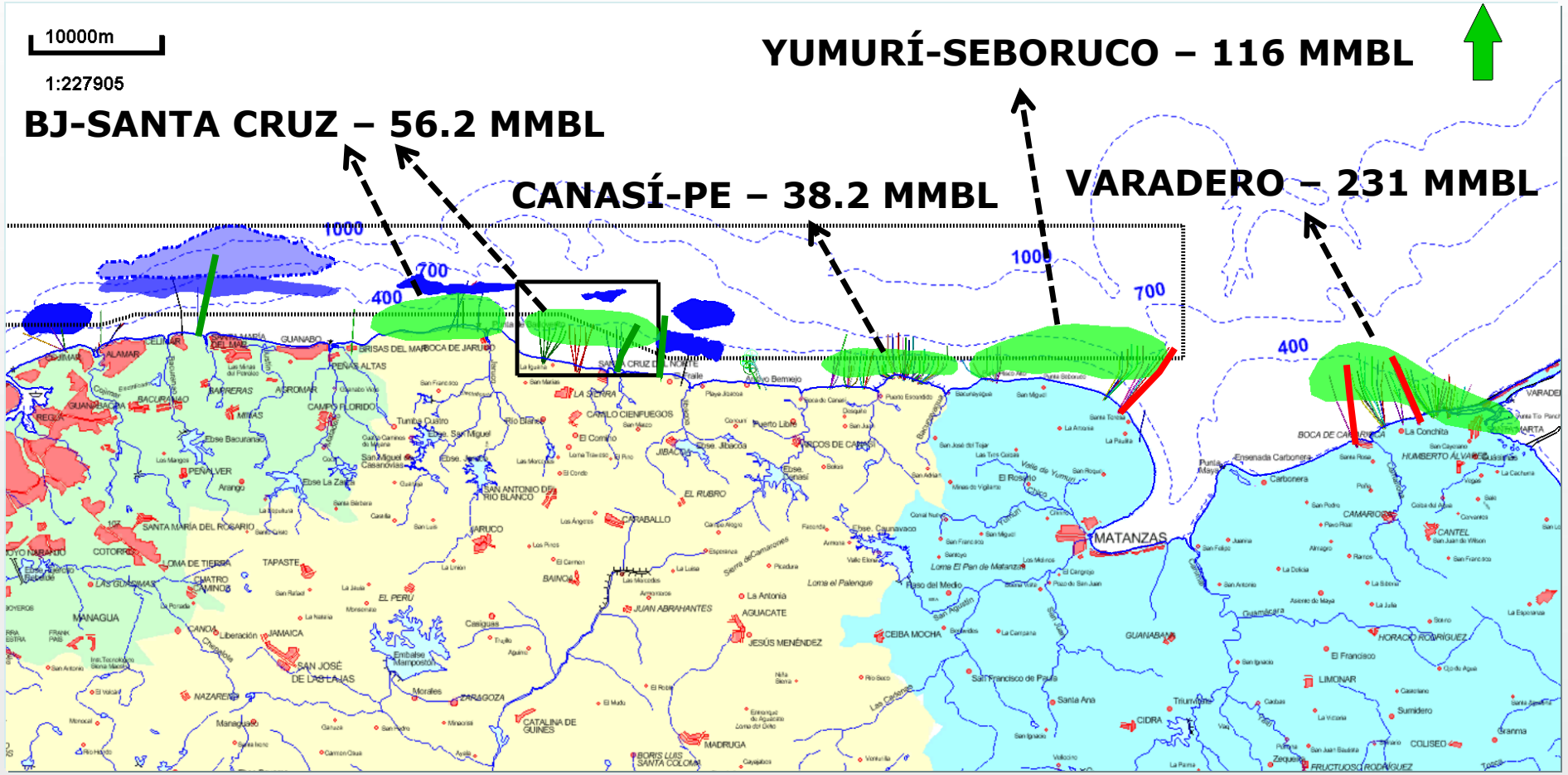
1. CUBA OIL AND GAS PRODUCTION.

- More than 99% of national production from Northern Oil Belt (NOB), area ~750 Km², exploited for >45 years.
- Daily production of ~45,000 bl/d and 2,700,000 m³gas/d (~ 60,000 bbloe/d).
- Oils are basically heavy (8-15°API) in NOB. In 2017 a new discovery was achieved 15 Km East of Havana, with a medium gravity oil production (22.6°API).



2. PETROLEUM SYSTEM ELEMENTS.

CUMULATIVE PRODUCTIONS IN NOB:



Some oil fields parameters:

Porosity: 14-20%
Permeabilities: 400 mD - 2 Darcies
Oil Saturation: 60-80 %

Net / Gross: 70-85%
Reservoir Temperatures: 45-65°C
Cumulative production per well: 2-6 MMbl.
Recovery factor: 5-7%

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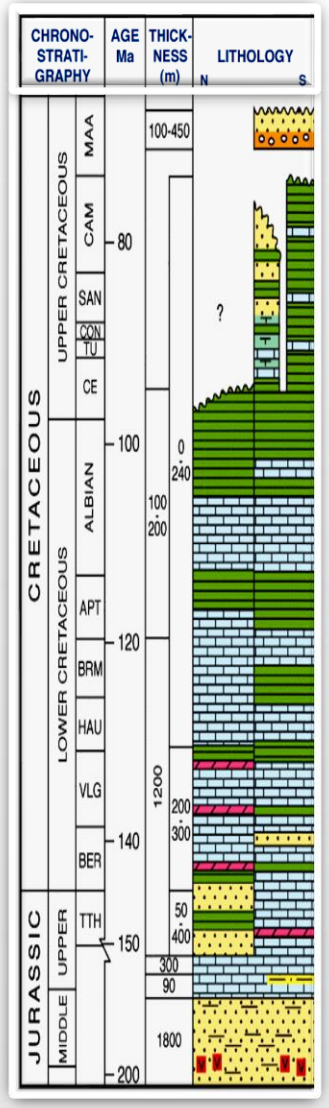
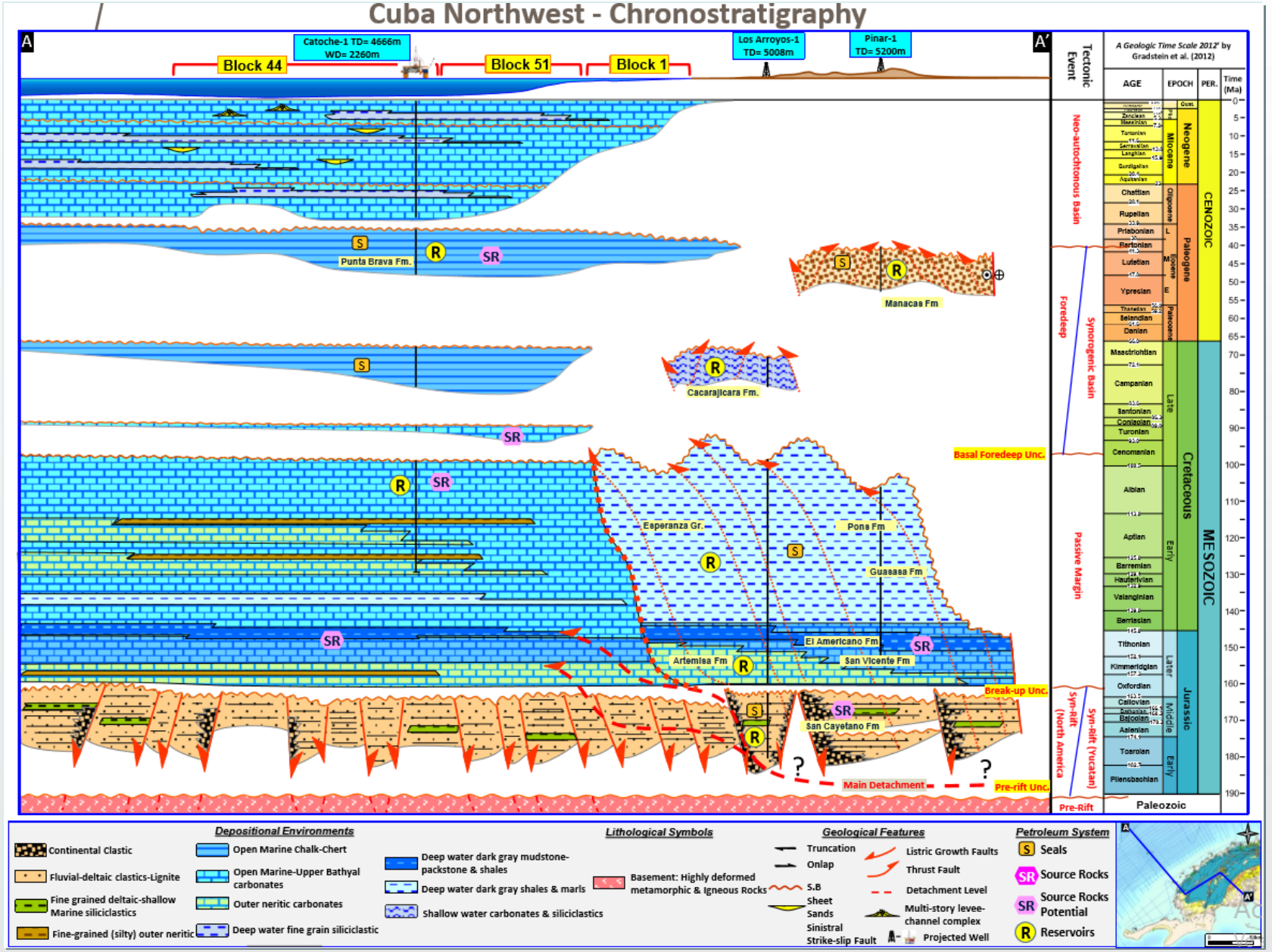
2. PETROLEUM SYSTEM ELEMENTS.

SOURCE ROCKS



Source rock level	Stratigraphic interval		TOC (%) Max (Ave)	Organic matter type
4	Cretaceous	Turonian Cenomanian	8.42 (0.5-3)	II, II-III and III
3	Cretaceous	Albian Aptian Barremian Hauterivian Valangianian Berriasian	16.11 3-6	II, IIS, II-III , III and I
2	Jurassic	Tithonian Kimmeridgian	5.60 (1.8)	II, II-III and III
1	Jurassic	Lower- Middle	7.86 (2)	III

2. PETROLEUM SYSTEM ELEMENTS.



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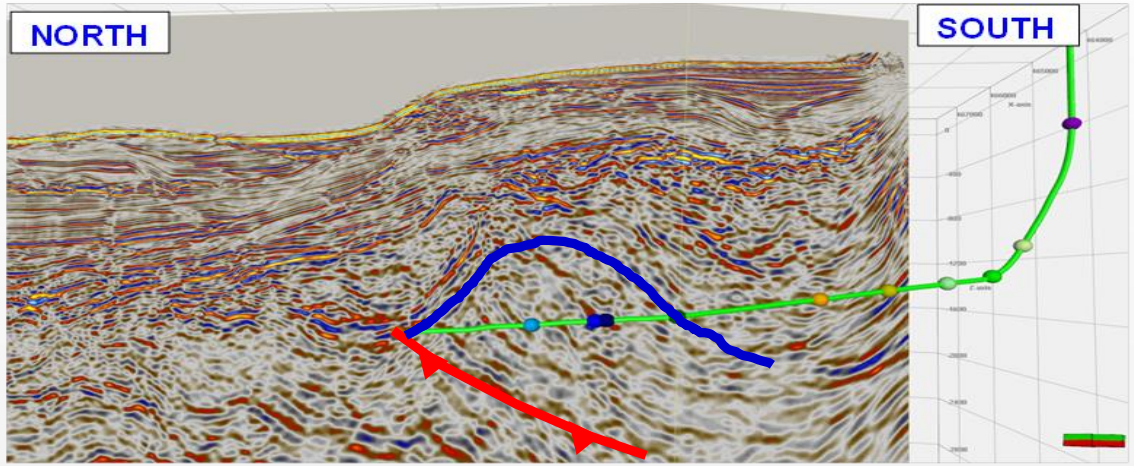
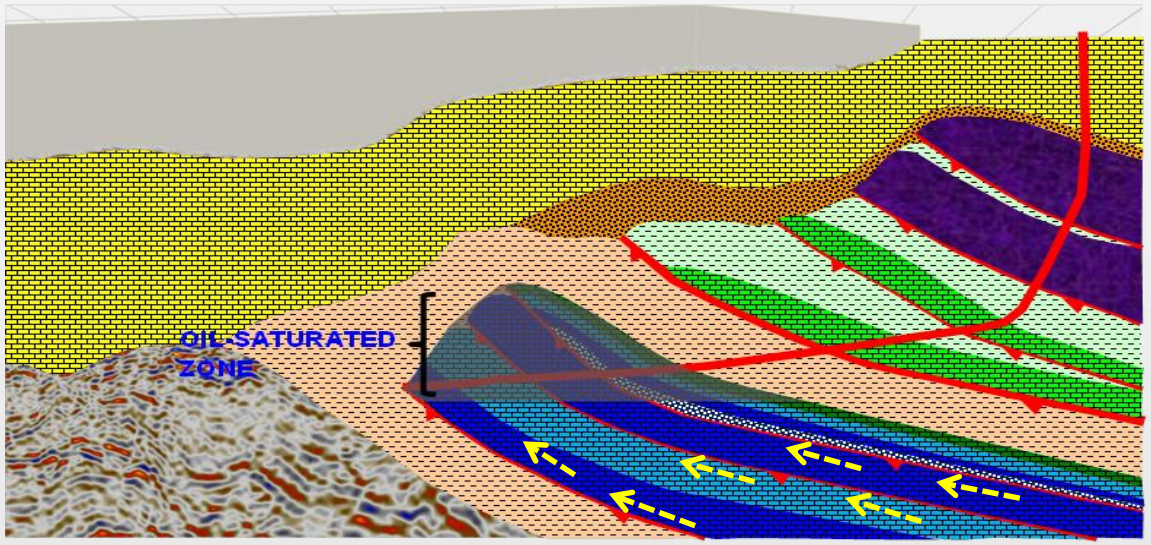




J3 Oxfordian
J3 Kimmeridgian
J3 Tithonian
K1 Neocomian
K1 Albian – K2 Turonian
K2 Campanian – Maastrichtian
Paleocene – Early Eocene
Early – Middle Eocene
Late Eocene – Miocene
Ofiolites

Seismic imaging and trap characteristics of Northern Oil Fields.

Petroleum System Elements:

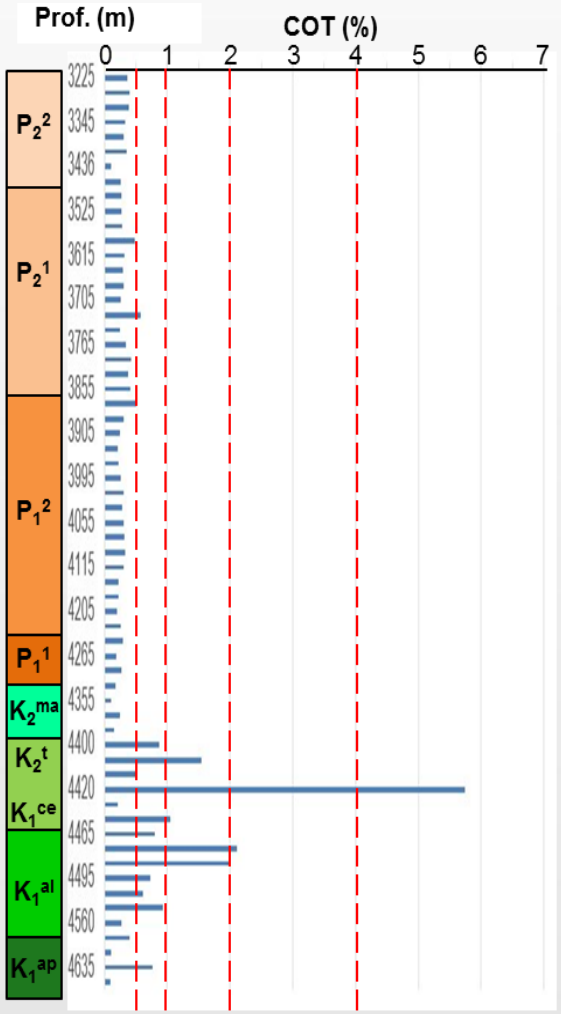
- **Source rocks:** clayey limestone and shale from Upper Jurassic (Oxfordian-Tithonian).
- **Reservoirs:** Naturally fractured and dissolved carbonates, Kimmeridgian and Tithonian.
- **Seal:** Tertiary shales, syn-tectonic sedimentation.

J_3-J_3 !

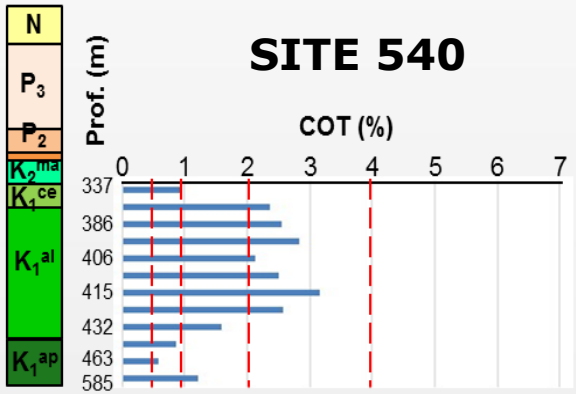
2. PETROLEUM SYSTEM ELEMENTS.

SOURCE ROCK POTENTIAL IN THE OFFSHORE

CATOCHE



SITE 540



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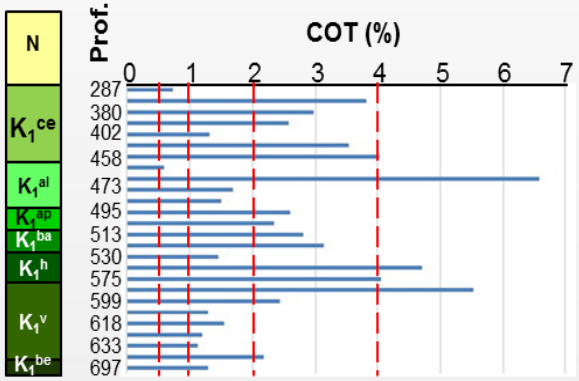
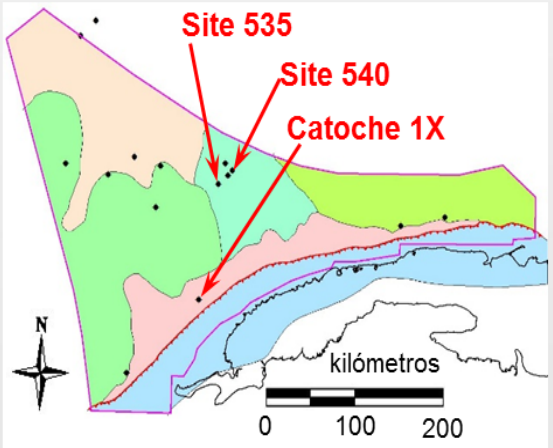
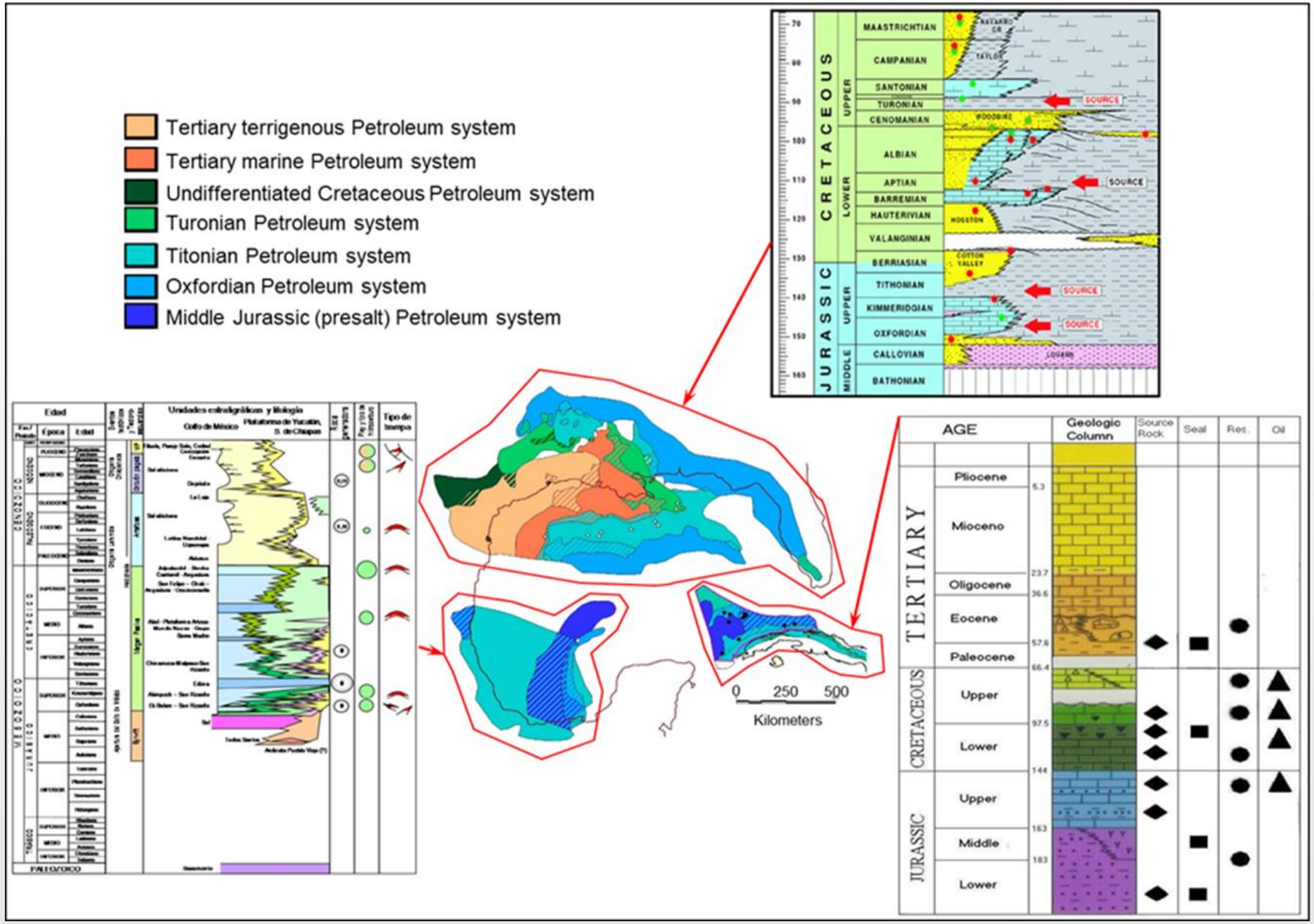
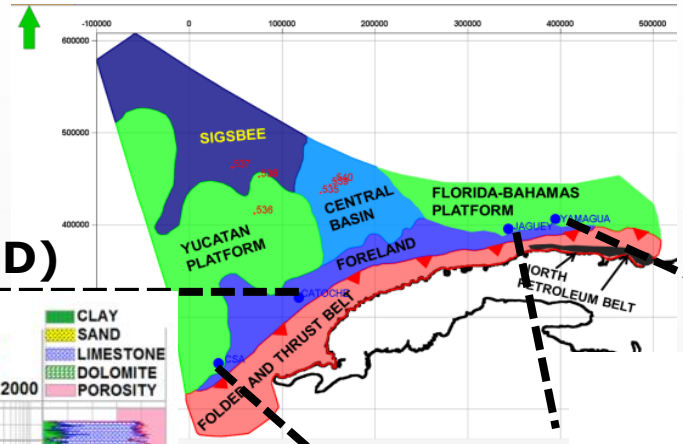




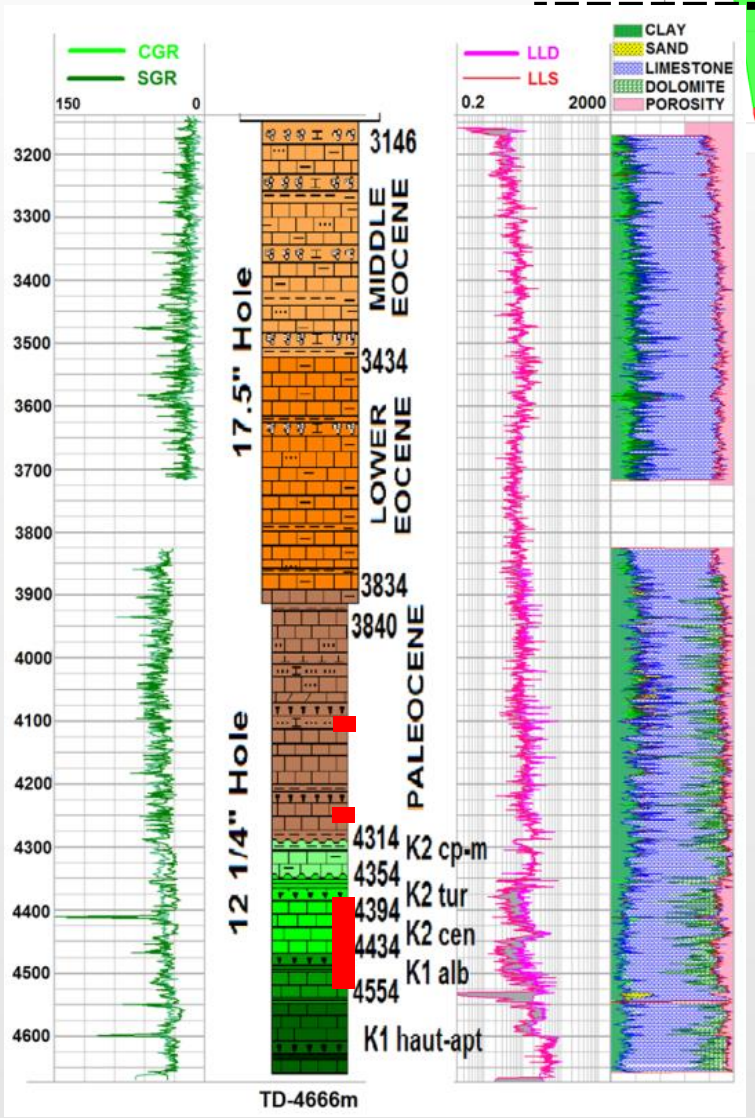
Source rock potential	COT (%)
Not potential	< 0.5
Low	0.5 - 1
Good	1 - 2
Very Good	2 - 4
Excelent	> 4

2. PETROLEUM SYSTEM ELEMENTS.



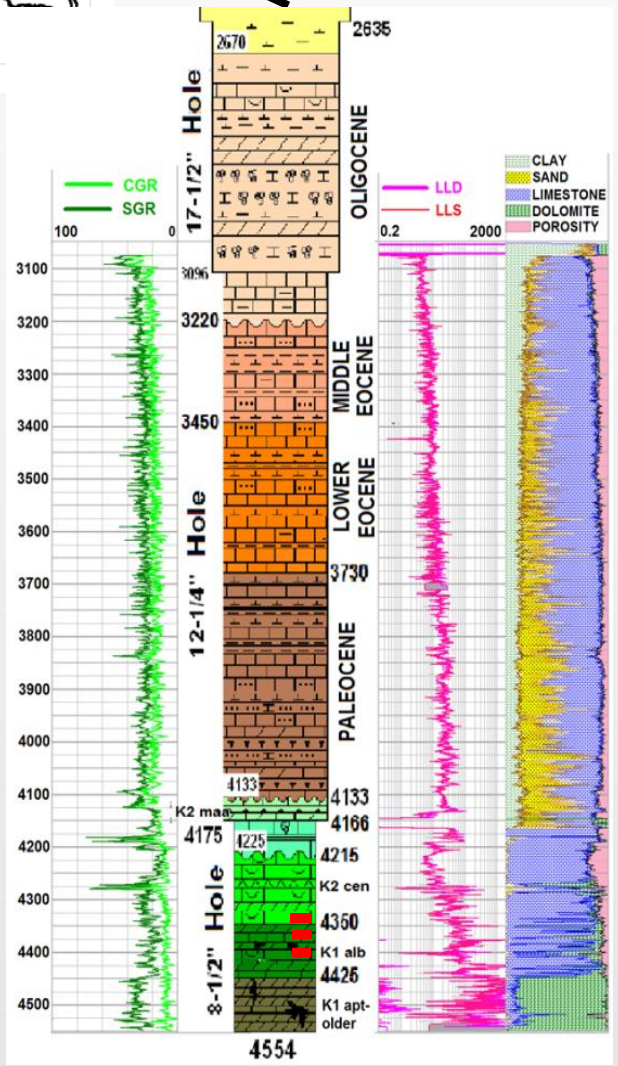


CATOCHE (FORELAND)



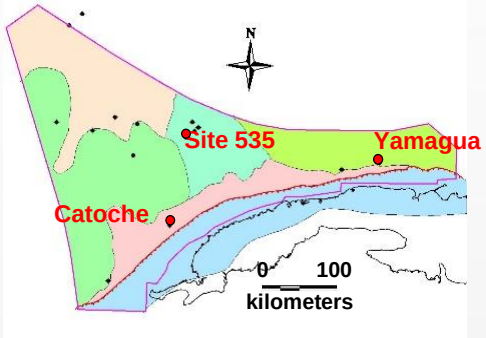
YAMAGUA-JAGUEY (FLORIDA-BAHAMAS)

CSA (YUCATAN)

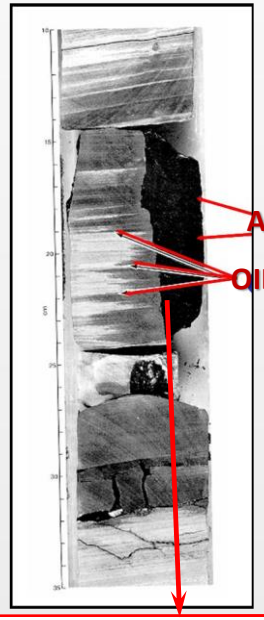


2. PETROLEUM SYSTEM ELEMENTS.

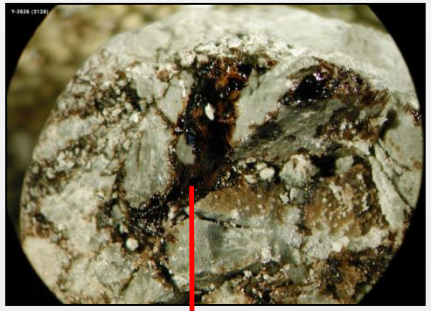
OIL SHOWS IN CUBAN OFFSHORE WELLS



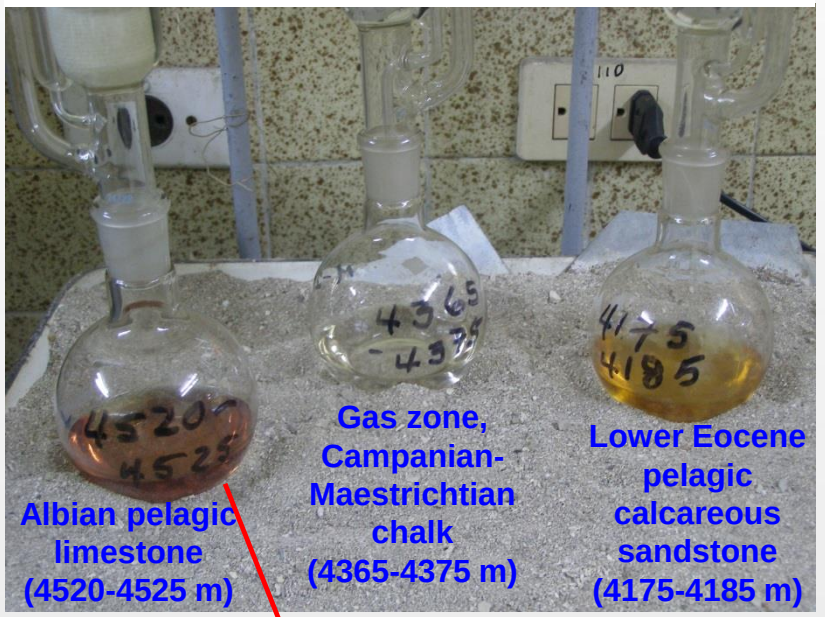
Site 535, 530-585 m



Yamagua 1X, 2515-2638 m

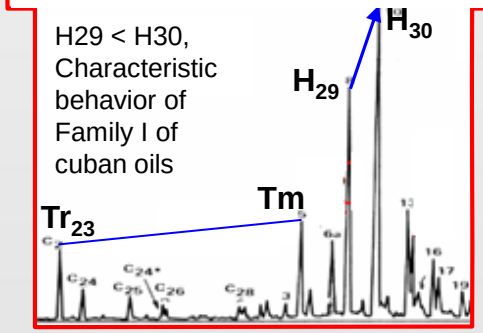


Catoche 1X
Hydrocarbons extractions from cuttings



Biomarker MZ 191 (Hopanes)

H29 < H30, Characteristic behavior of Family I of cuban oils



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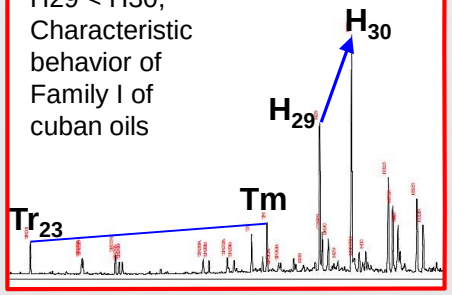
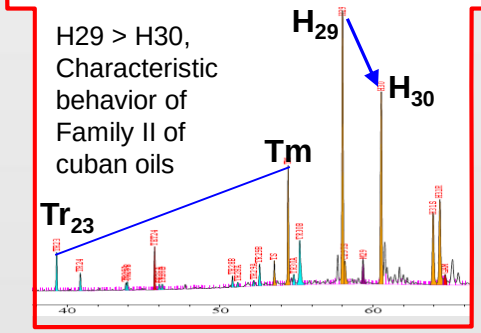


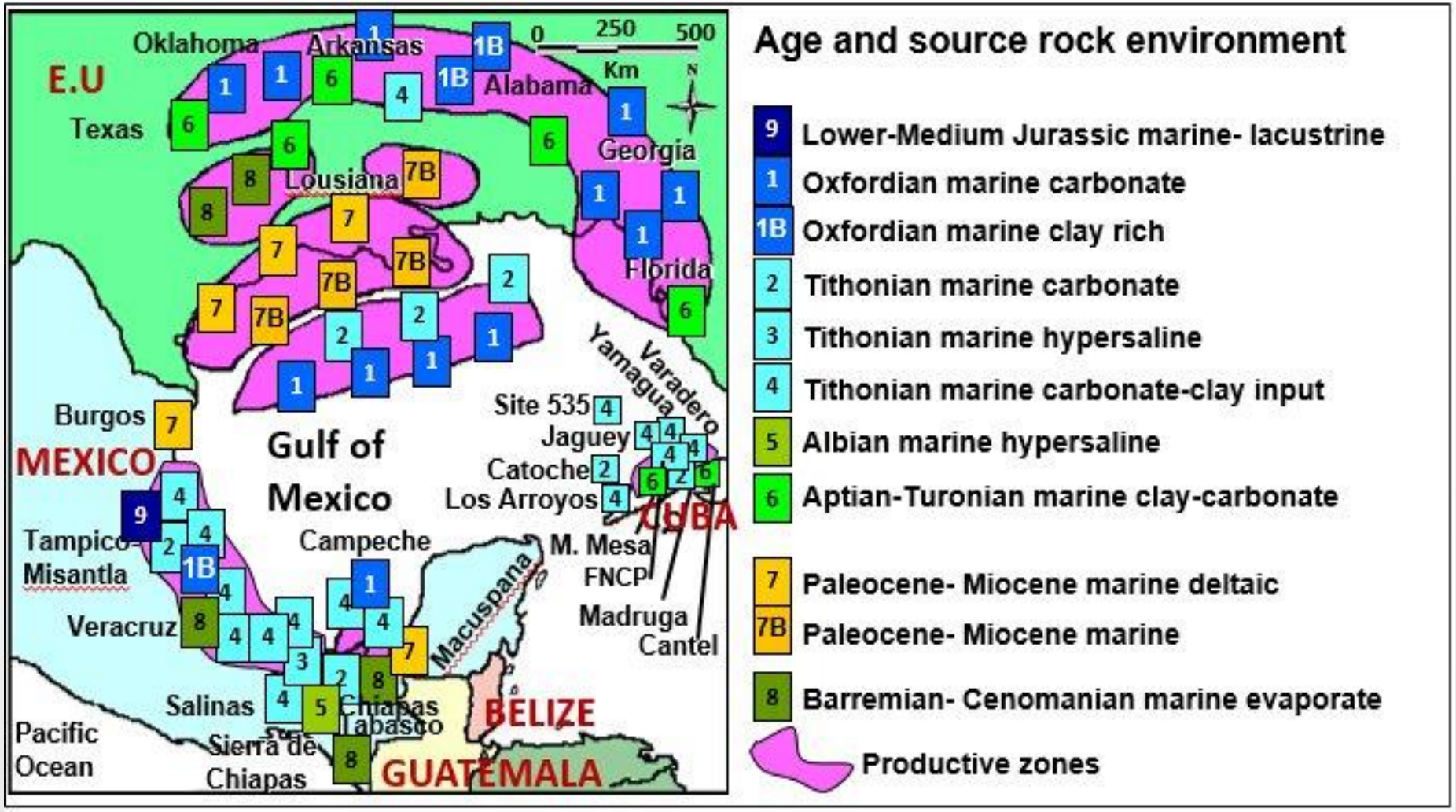
Biomarker MZ 191 (Hopanes)

H29 > H30, Characteristic behavior of Family II of cuban oils



2. PETROLEUM SYSTEM ELEMENTS.

OIL TYPES AND SOURCE ROCKS IN GoM BASIN

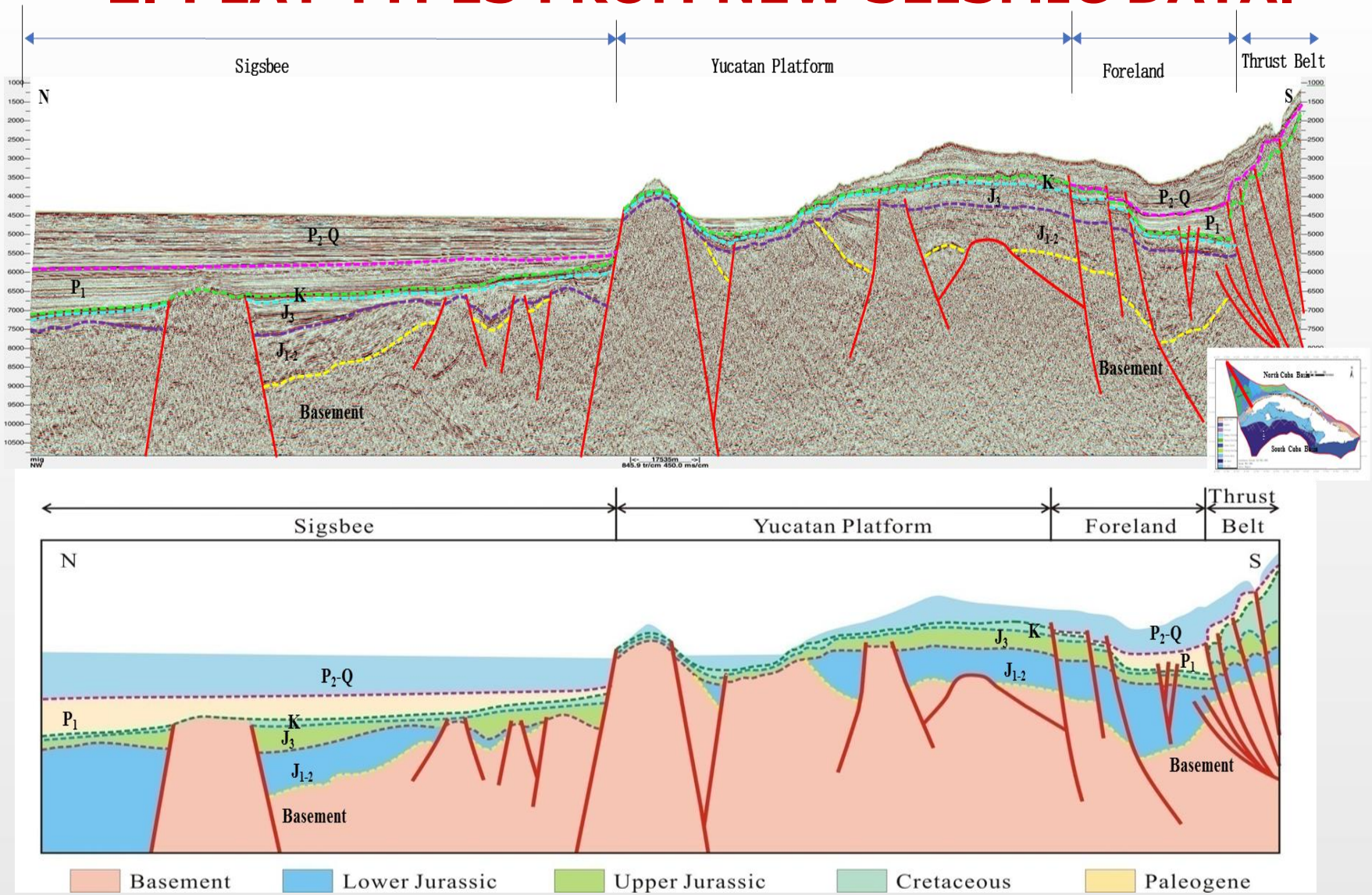


Family I of Cuban oils, correlates with Family 4 of Gulf of Mexico

Family II of Cuban oils, correlates with Family 2 of Gulf of Mexico

Family III of Cuban oils, correlates with Family 6 of Gulf of Mexico

2. PLAY TYPES FROM NEW SEISMIC DATA.

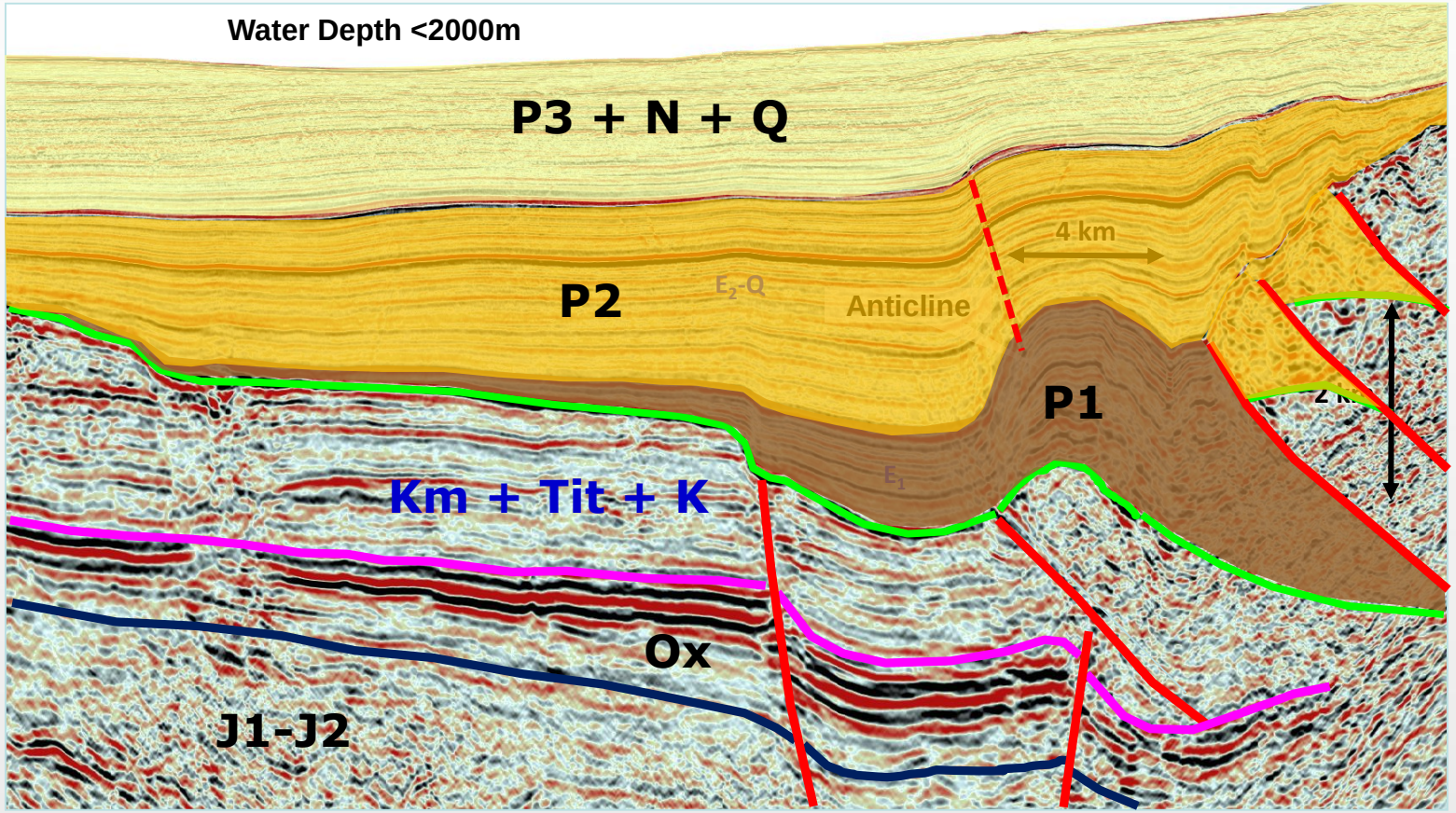


PLAY TYPE-1: FOLDED BELT DUPLEXES

PLAY TYPE-2: FAULTED BLOCKS (HORST)

2. PLAY TYPES FROM NEW SEISMIC DATA.

PLAY TYPE-1: DUPLEXES IN FOLDED BELT



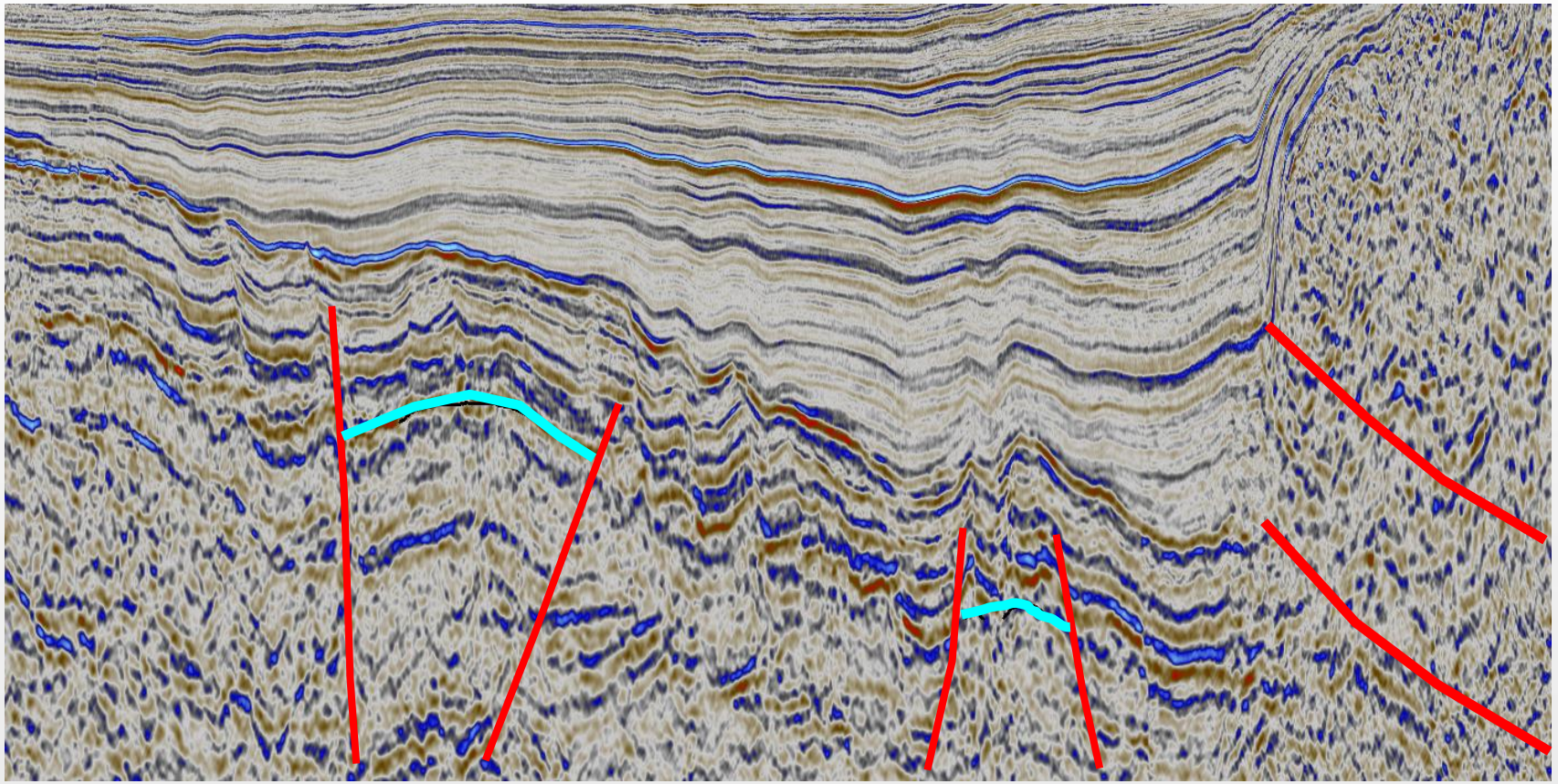
Geometry of duplexes structures in the folded belt, block N36.

Proven petroleum system:

Source Rock: shale and clayey lst (J3)
Reservoir: Fractured carbonates (J3-K1)
Seal: shale (P1-P2)

2. PLAY TYPES FROM NEW SEISMIC DATA.

PLAY TYPE-2: FAULTED BLOCKS (HORST)



BLOCK N50

Petroleum system:

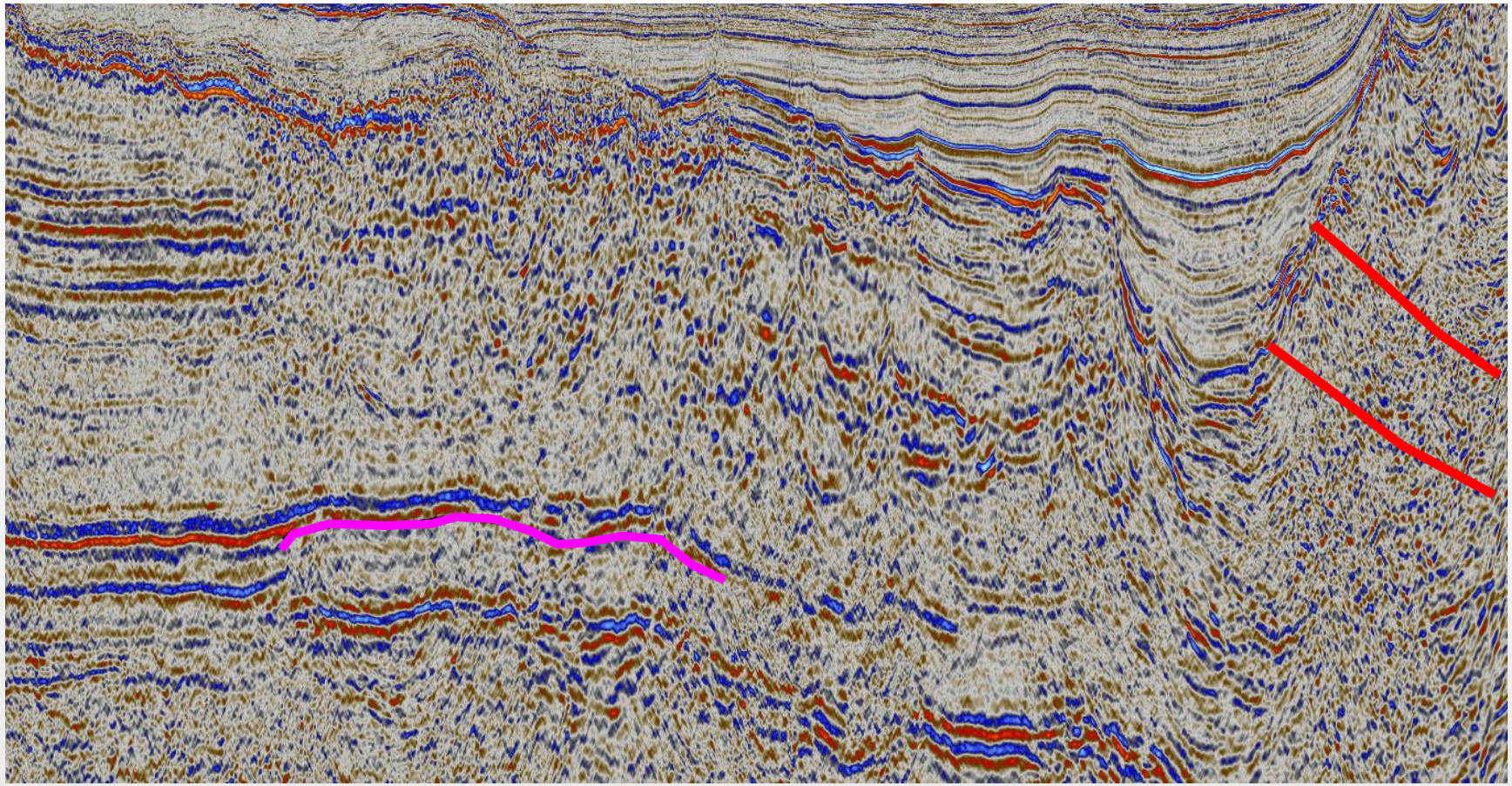
Source Rock: shale and clayey limestone (J3).

Reservoir: Fractured carbonates (J3, Kimmeridgian).

Seal: shale and clayey limestone (J3, Tithonian).

2. PLAY TYPES FROM NEW SEISMIC DATA.

PLAY TYPE-3: OXFORDIAN **BLOCK-N26**



Petroleum system:

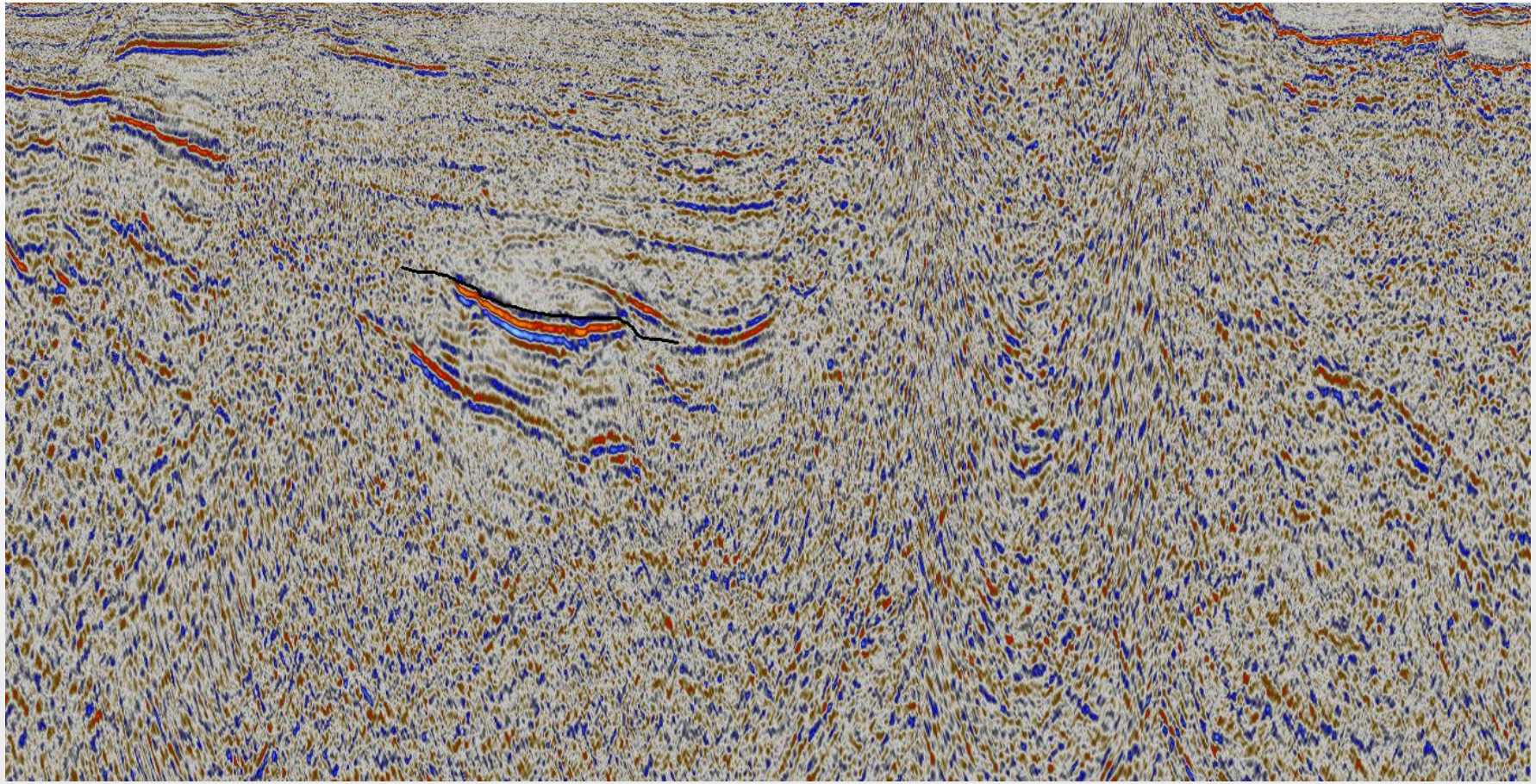
Source Rock: shale (Oxfordian and older).

Reservoir: Porous dolomites and sandtones (J3, Oxfordian).

Seal: Oxfordian shale and Kimmeridgian anhydrite.

2. PLAY TYPES FROM NEW SEISMIC DATA.

PLAY TYPE-4: SYN-RIFT SANDSTONE **BLOCK-N32**



Petroleum system:

Source Rock: shale (Syn-rift, Lower-Middle Jurassic).

Reservoir: Sandtone (Syn-rift, Lower-Middle Jurassic).

Seal: shale (Syn-rift, Lower-Middle Jurassic).

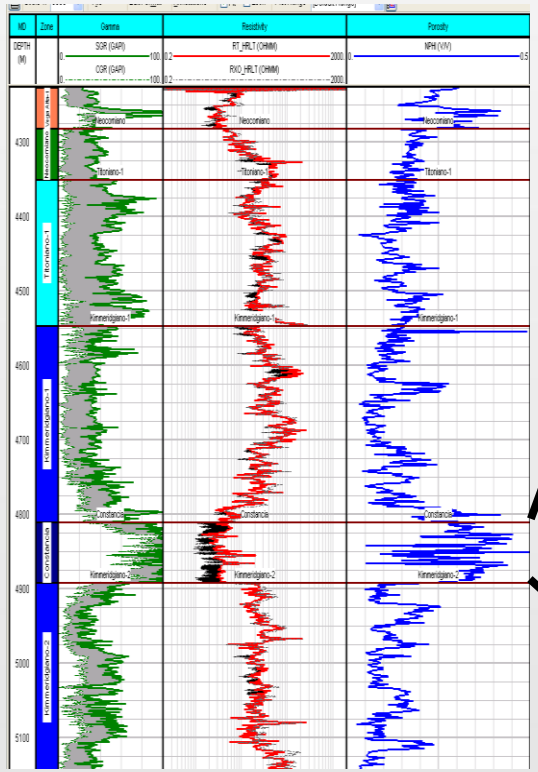
2. PLAY TYPES FROM NEW SEISMIC DATA.

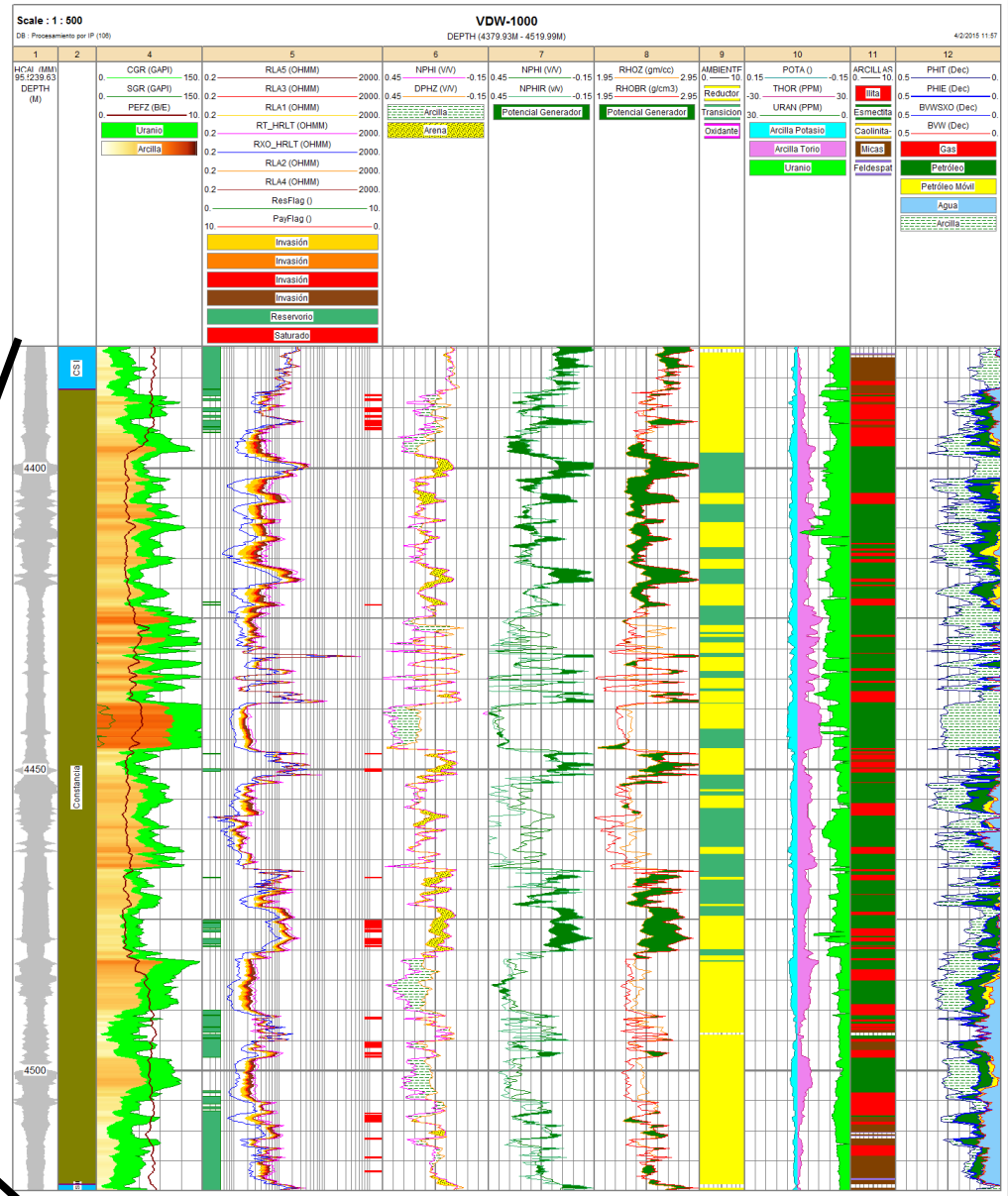
PLAY TYPE	TRAP CHARACTERISTICS	REGIONAL ANALOGUES
DUPLEXES	Thrust sheets associated to Northern Cuban Folded belt. Reservoir are fractured and karstified pelagic carbonates from Upper Jurassic-Lower Cretaceous. Seal is Paleogene shale.	Varadero (Cuban Fold Belt)
FAULTED BLOCKS (HORSTS)	Structural highs, with high energy carbonates mainly from Kimmeridgian. Seal are clayey deep water carbonates and tight limestone.	San Andres? (Mexico)
OXFORDIAN	Stratigraphic, sandstone reservoir sealed by interbedded shale.	Norphlet? (US)
LOWER-MIDDLE JUR.	Lower-Middle Jurassic sandstone, seal of Callovian anhydrite and internal shale.	Pre-salt? (Mexico)

2. PLAY TYPES FROM NEW SEISMIC DATA.

PLAY TYPE-3: OXFORDIAN

New play type, hypotethical, based on the latest discoveries in GoM (Norphlet Play) and some similarities with Cuban facies. Oxfordian is composed by shale, sandstone and dolomites.





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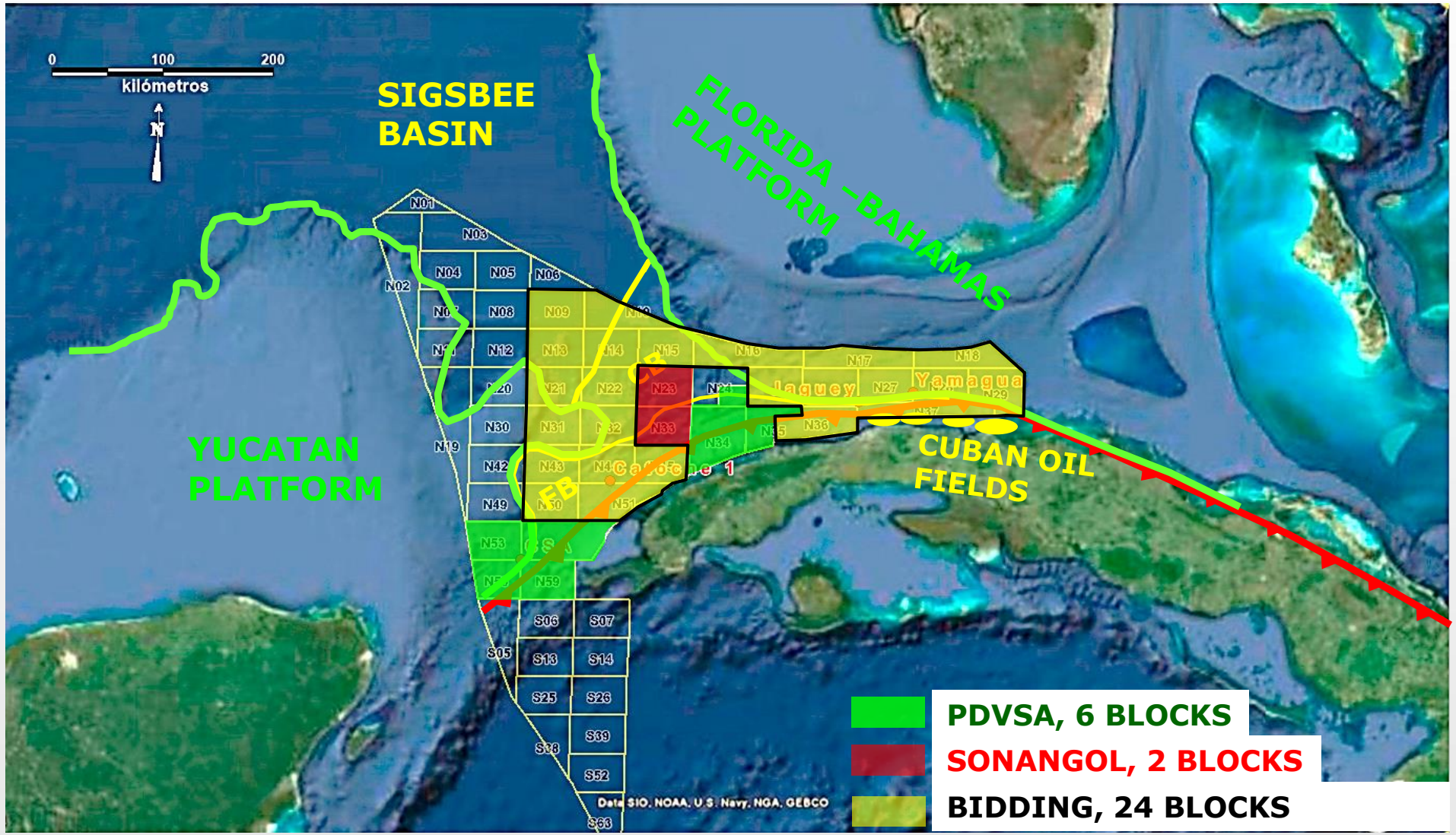
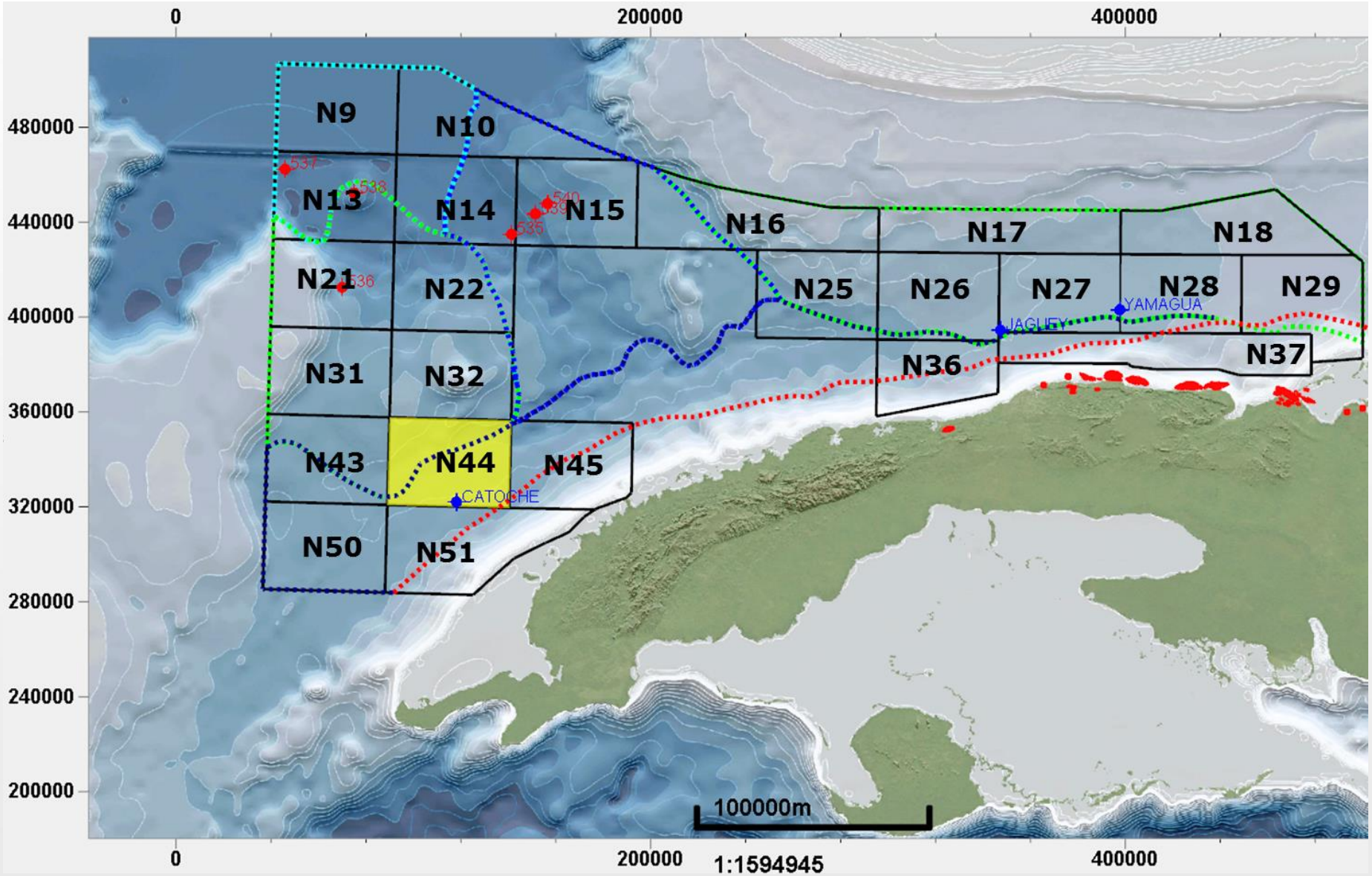
3.GENERAL CHARACTERISTICS OF BIDDING BLOCKS.



Cuban oil fields in Fold Belt have and area of ~750 km² (96% in Western offshore is unexplored).



FOLDED BELT

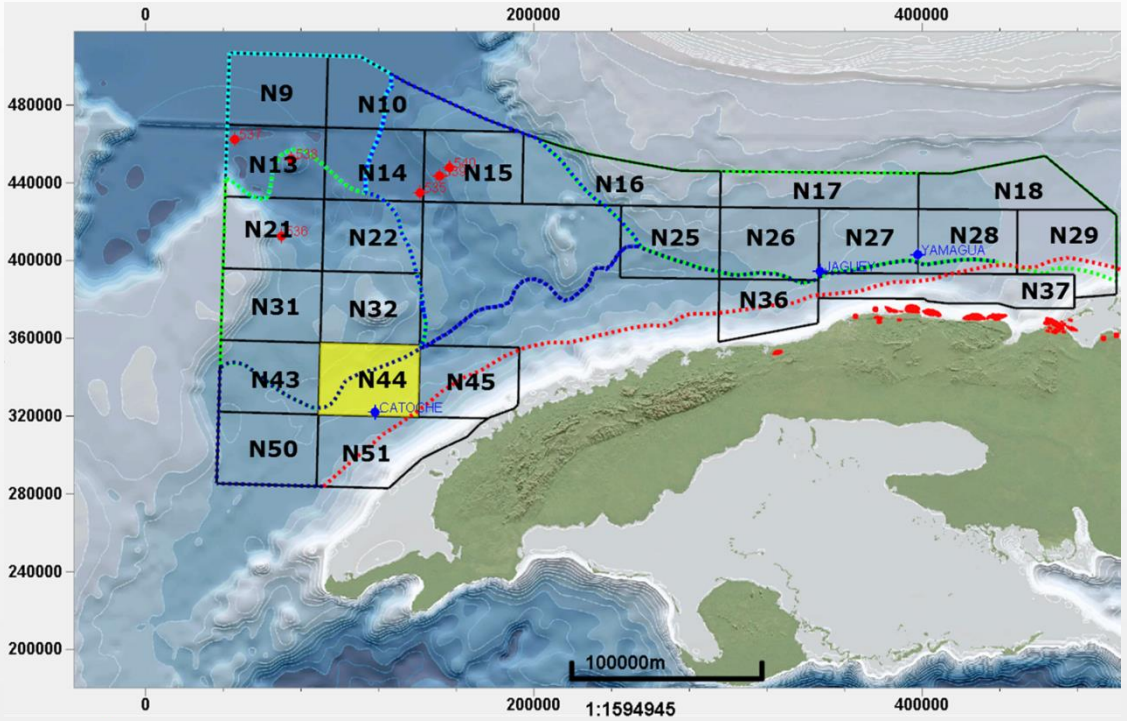
FORELAND BASIN

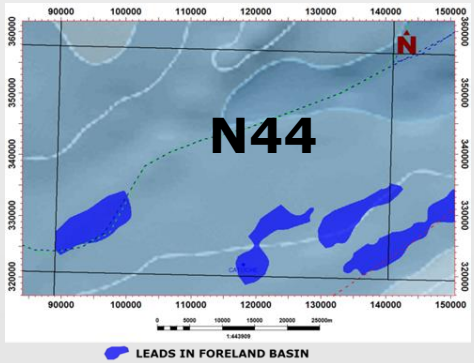
CENTRAL & SIGSBEE BASINS

YUCATAN & FLORIDA-BAHAMAS PLATFORMS

CUBAN OIL FIELDS

1.GENERAL CHARACTERISTICS OF BIDDING BLOCKS.





1. Blocks are proposed based on available data, prospectivity criteria and vecinity to productive area of Cuban folded belt.

2. Block acreage is 1800-2000 Km². Sea bottom depth from 500-3000 m.

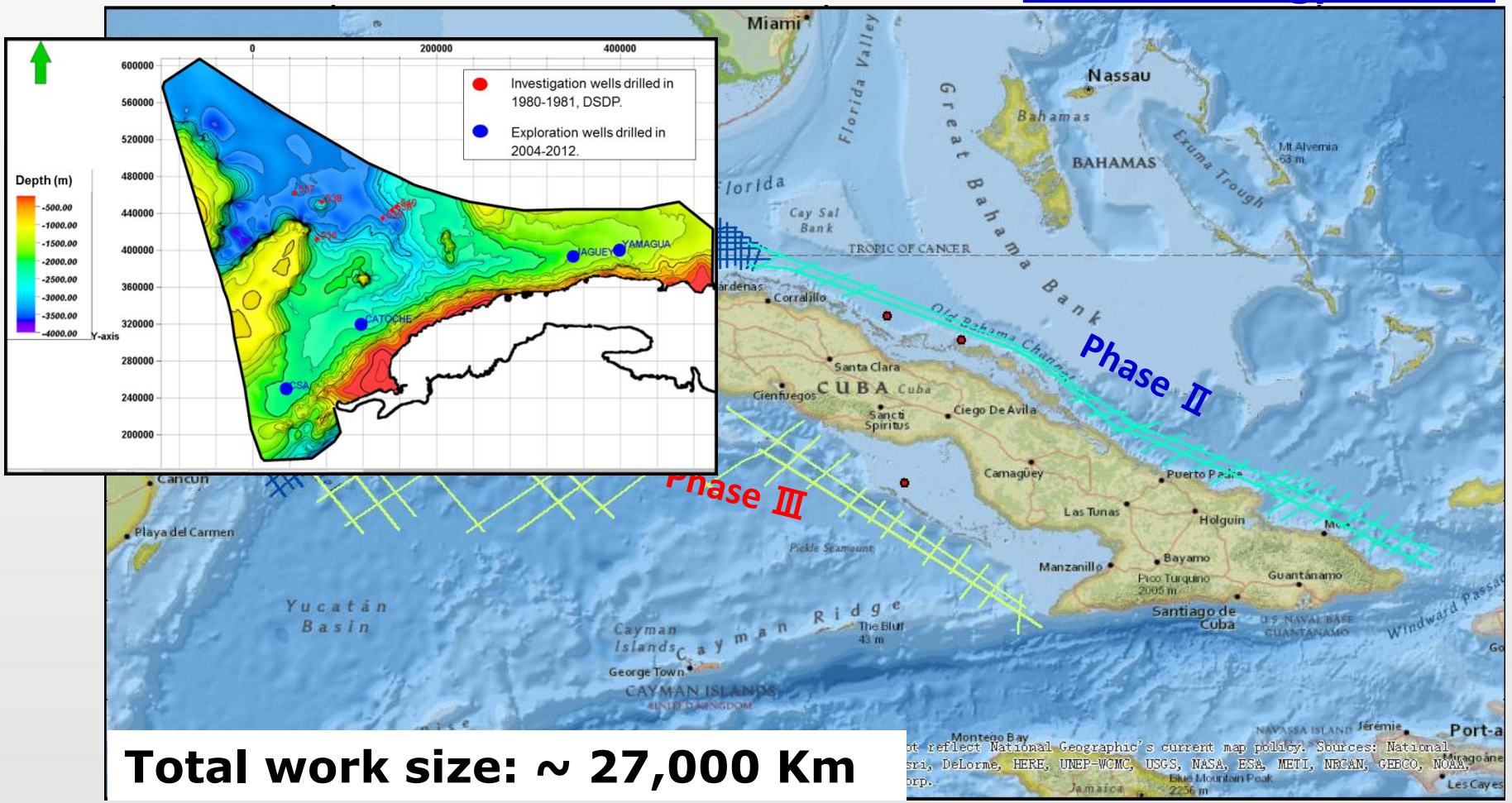
3. For volumetrics and risk assessment, parameters from Cuban oil fields and surrounding areas of Mexican side were considered.

3.GENERAL CHARACTERISTICS OF BIDDING BLOCKS.

- **High quality data was recently acquired and processed (PSTM & PSDM). The streamer length was 10-12 Kms to illuminate deep targets.**

- **PSTM & PSDM data is now available to be negotiated with BGP.**

multiclient@bgp.com.cn



Total work size: ~ 27,000 Km