



# ASPO

## March 2024

The main O&G conventional discoveries in 2023

Some highlights on Unconventional ventures

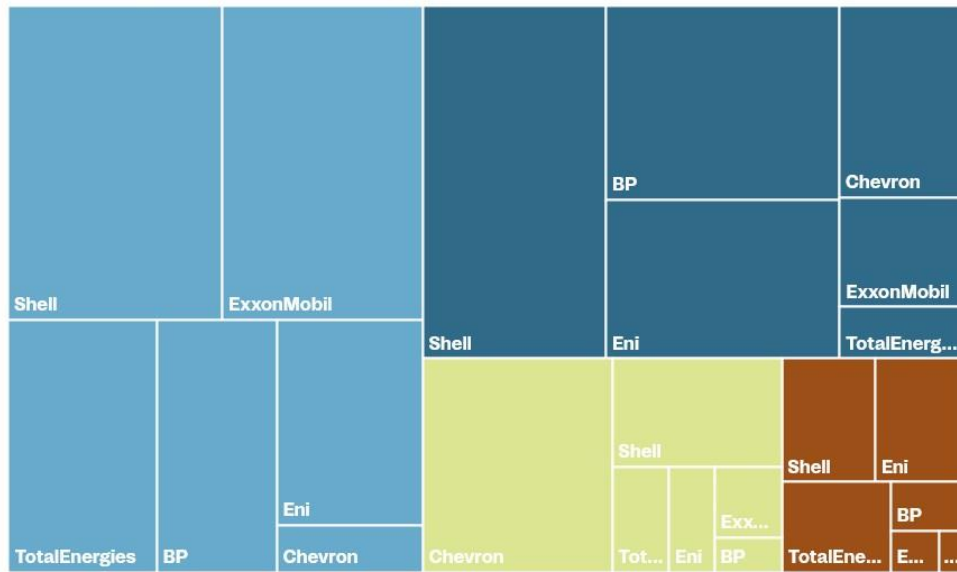
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# Post COVID low level Exploration investments remain / Very deep waters appeal

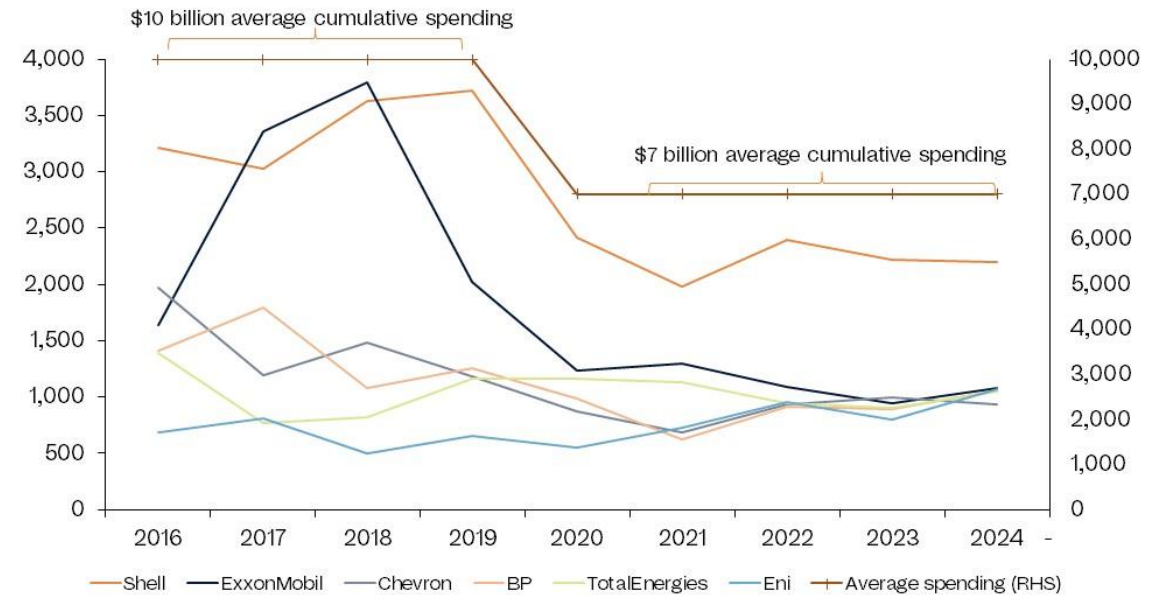
**Majors drilling activity by water depth, 2024**

■ Ultra-deepwater - 43% ■ Deepwater - 35% ■ Shelf - 7% ■ Land - 14%



RystadEnergy

**Majors' year-on-year and average exploration spending USD million**



RystadEnergy

Source: Rystad Energy's Upstream Solution, February 2024  
A Rystad Energy graphic

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A Rystad Energy graphic

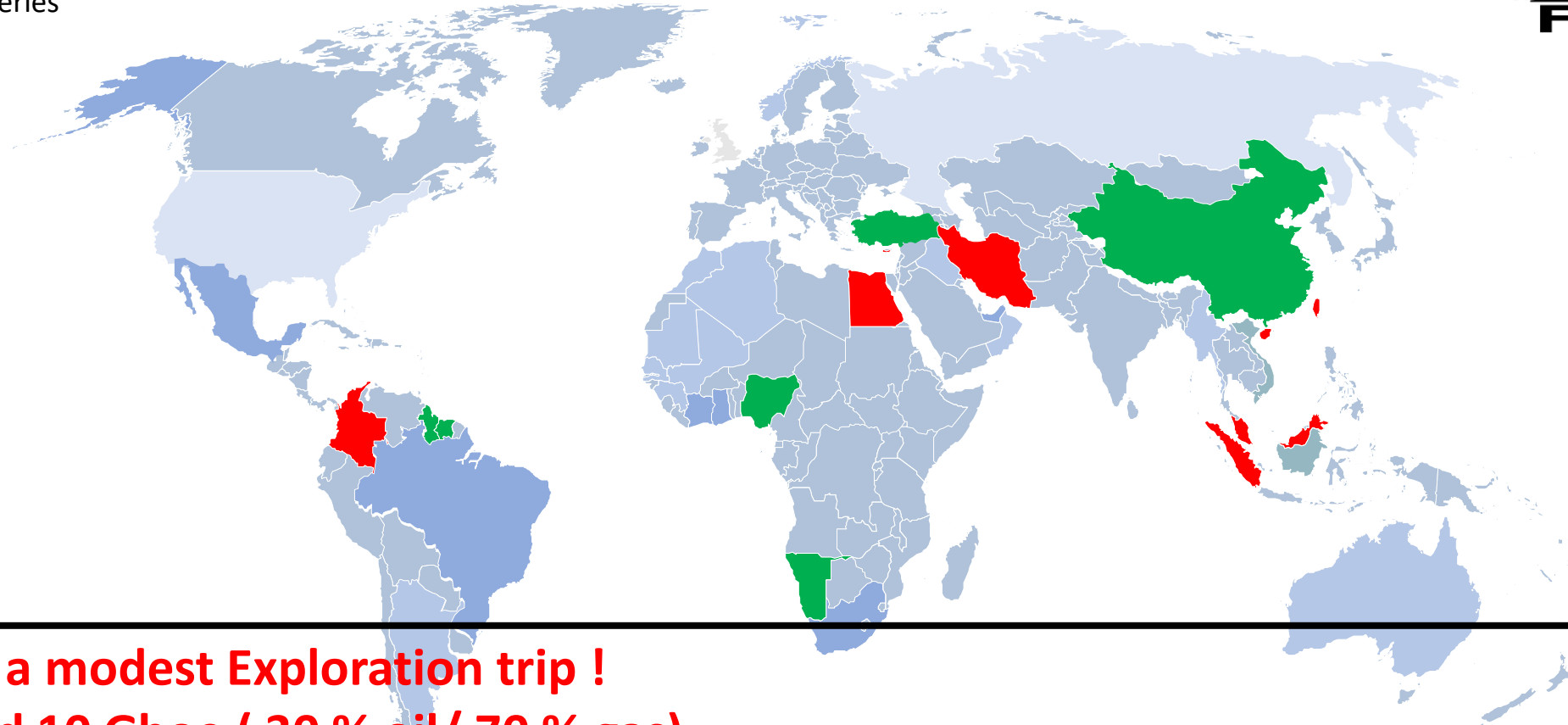
But money doesn't buy happiness !  
Ultra deep Offshore = 1/3 of the discoveries and majors 1/4 of discoveries

# 2023 Conventional EXPLORATION SYNTHESIS

## Exploration / Appraisal



- OIL and
- GAS Discoveries



**2023 : a modest Exploration trip !**  
**Around 10 Gboe ( 30 % oil/ 70 % gas)**

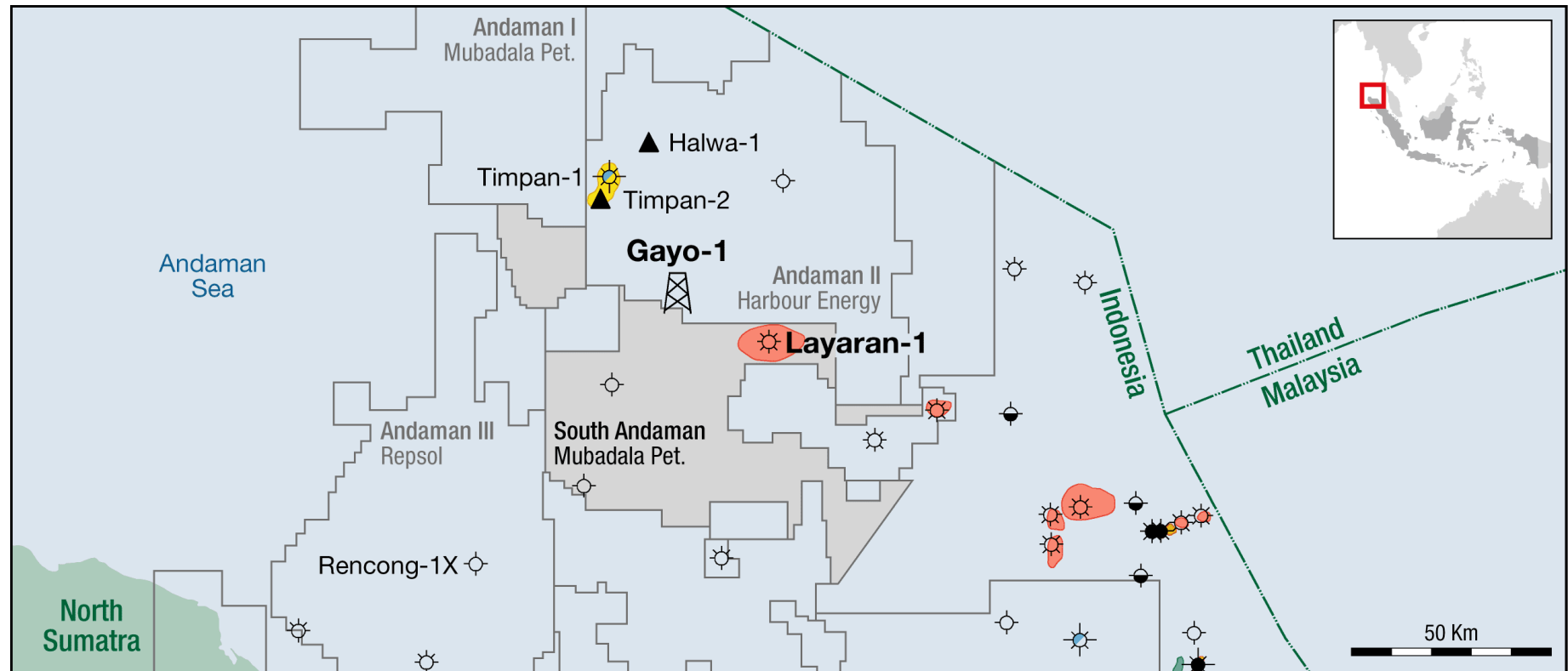
**Oil discoveries :** China, Iran, Turkey, Guyana, Nigeria, Namibia  
**Gas discoveries:** Indonesia, Malaysia, Iran, Egypt, Colombia

# Indonesia Adaman Sea Gas discoveries

Two major dry gas discoveries in Adamanan Sea (Indonesia) in 2023: Timpan and Layaran (3 to 5Tcf each),

DHIs supported sandstones  
2 explo wells planned in 2024 : Gayo and Halwa

Medium size companies :  
Mubadala and Harbour Energy



# Indonesia : Adaman Sea Mio-Oligocene basin

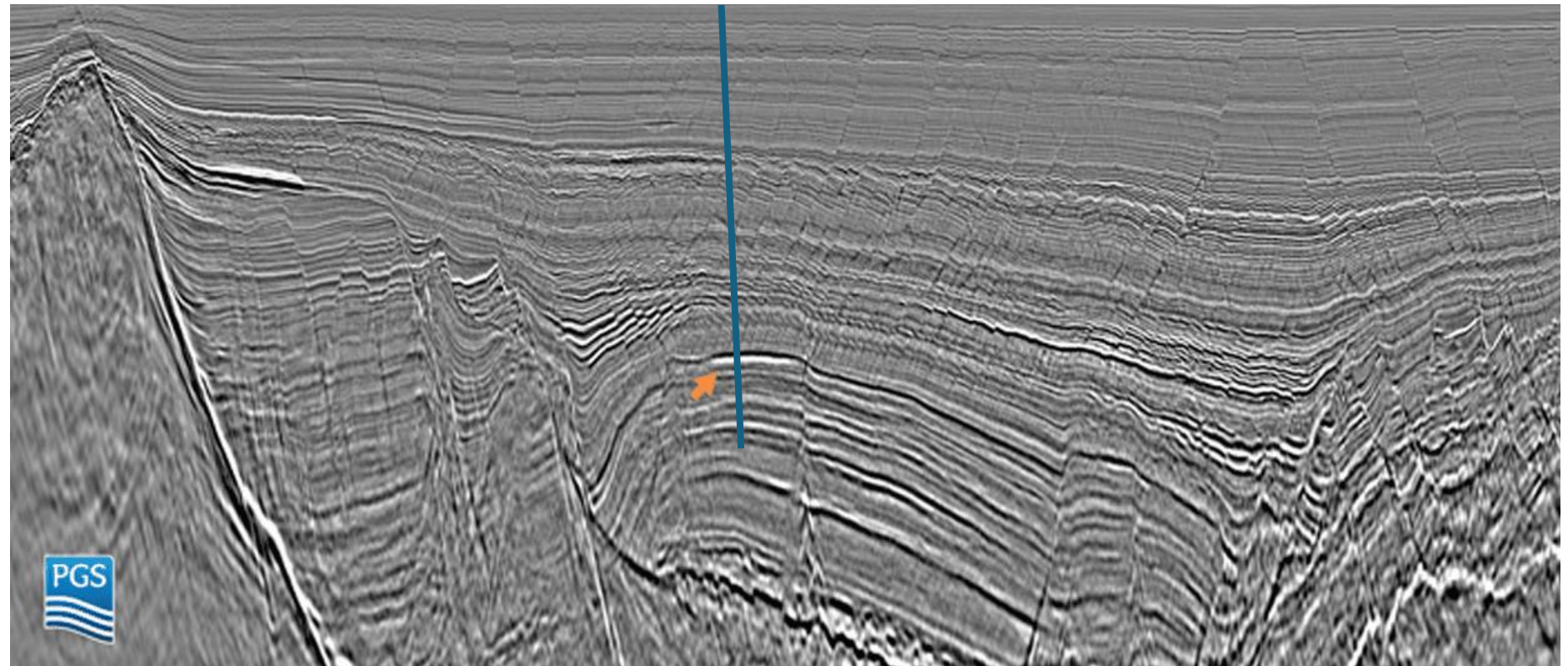
Tympan 1 well by  
Harbour Energy (40 %),  
bp (30%) and  
Mubadala (30%)  
WD:1400 m/TD:4211m

390' Gas column in  
Upper Oligocene  
sandstones

Excellent DST  
1 M.m<sup>3</sup>/d + 1800 bc/d

1 to 6 Tcf  
20 to 120 Mbc

Tympan 1 Well



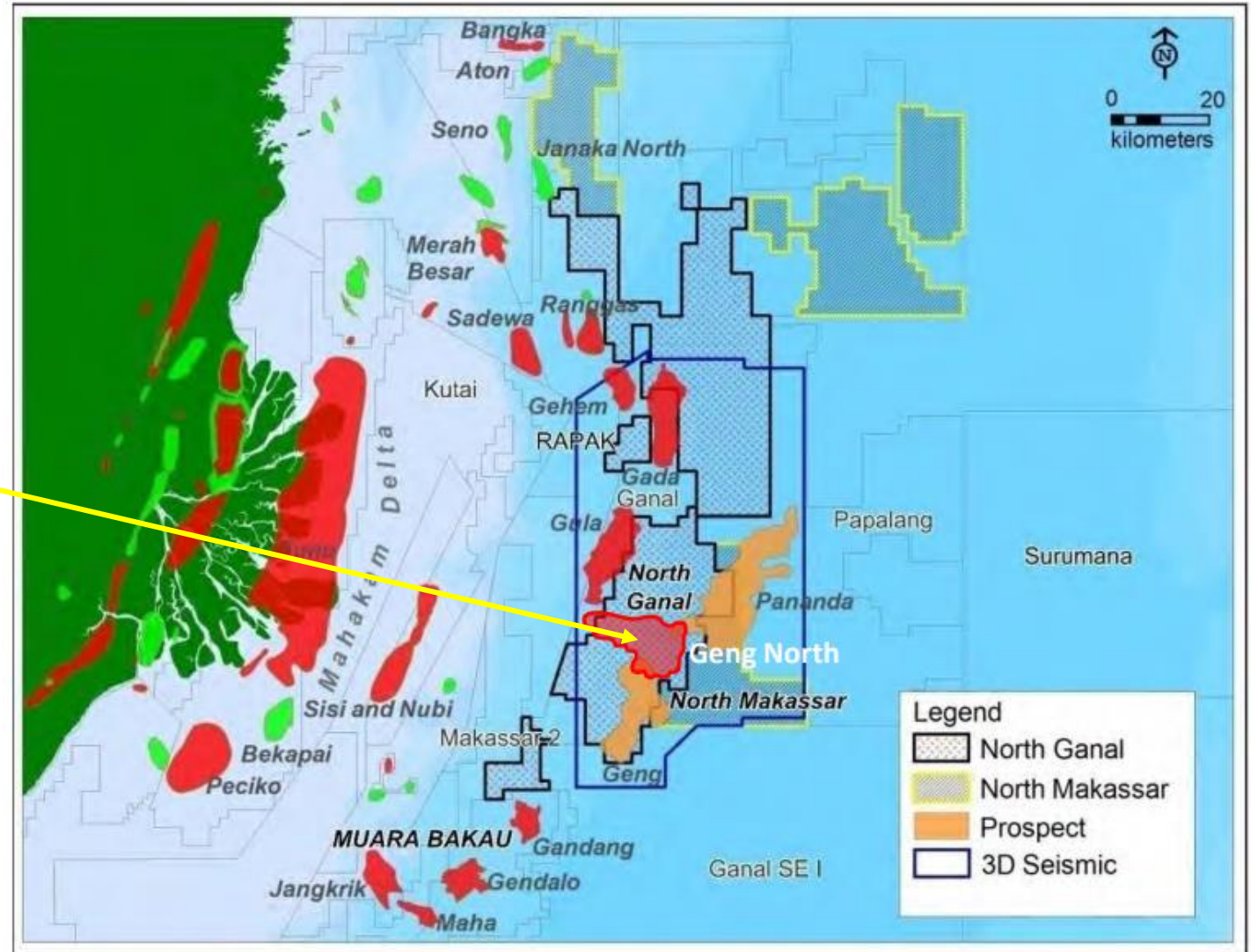


# Indonesia : Deep Mahakam Discovery : Geng North-1 by Eni

Eni op 50%, Neptune Energy (38%) and Agra (12%)  
WD : 1950 m TD / 5025 m

A more than 11 years journey to discovery since dry Panada drilling in 2012 (siltstones/shales in outboard Geng North)  
Stratigraphic trap (fan)  
Excellent 50 m net pay in Miocene sandstones

DST deliverability of 80 MMscfd with 6000 bcpd  
Reserves : 3.5 Tcf/150 Mbc  
Production (expected) 1 Gm<sup>3</sup>/y +3Mbo/y



# Malaysia Sarawak new gas cluster -

PTTEP op60%, MITSUI 25%,  
PETRONAS 15%  
Several **sweet gas** discoveries  
Thick up to 200 m  
Miocene/oligocene sandstones  
  
No reserves published



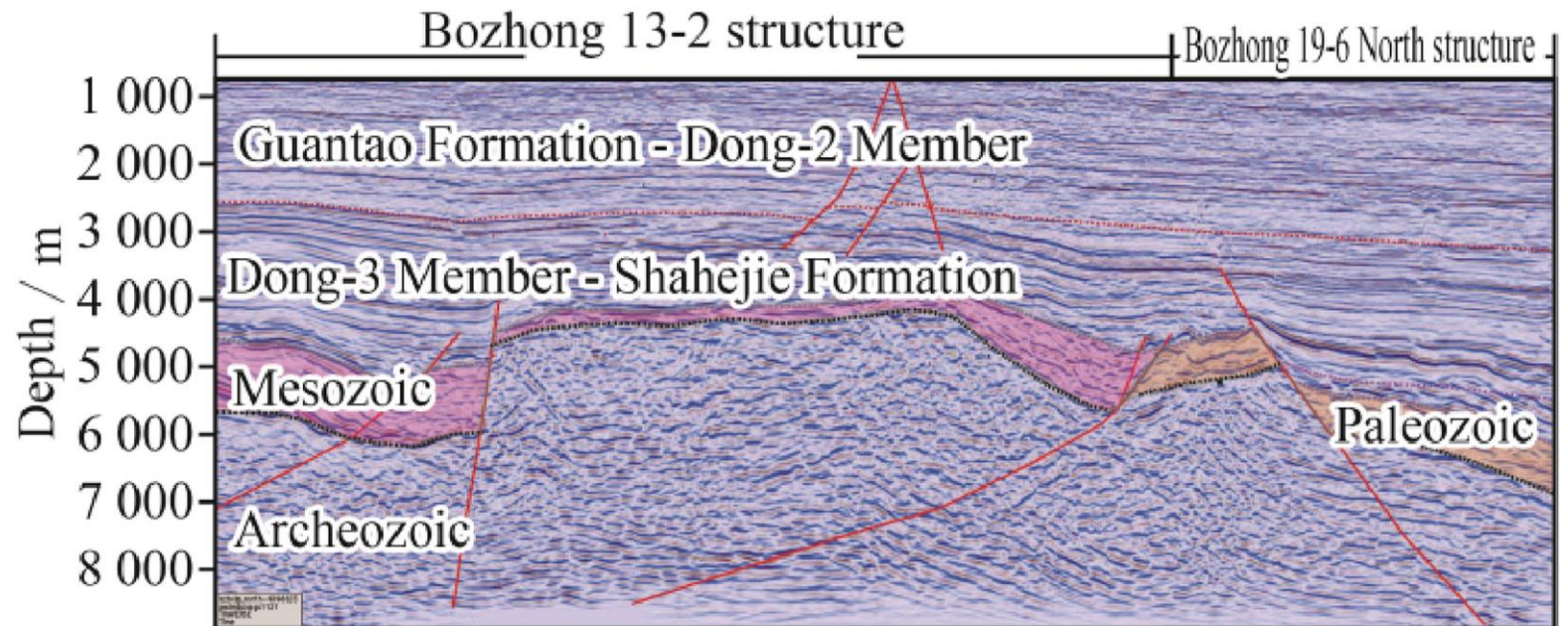
# China : Bohai Bay : Bozhong 26-6 discovery

CNOOC Ltd. Op , 100 %  
Well Bozhong 26-6-2 south of  
Bohai Sea WD: 22m. TD: 4,480 m  
and encountered a total 320 m of  
oil pay zones **in Archean  
buried hill**, below Mesozoic  
seal; Source-Rock : Paleogene

DST flowed at an average 2,040  
b/d crude light oil and 11.45  
MMcfd of gas

Reserves ; 600 Mbo + several Tcf  
?

If similar to Bozhong 13-2 (see  
right slide) and Bozhong 19-6





# IRAN : Discoveries in NE frontier basins and Giant gas find in Fars

New « frontier » basins close to Turenstan being explored with significant discoveries

- Hirkan oil field in Golestan
- Chesmeh Al Shour gas filed in Khorazan

Mature exploration led to

- a giant gas field in Fars province (below salt) : **Lamerd = 22 Tcf IGIP**
- tw oil fields i Buskehr province : Tengoo and Genaveh



# Largest Turkish oil discovery

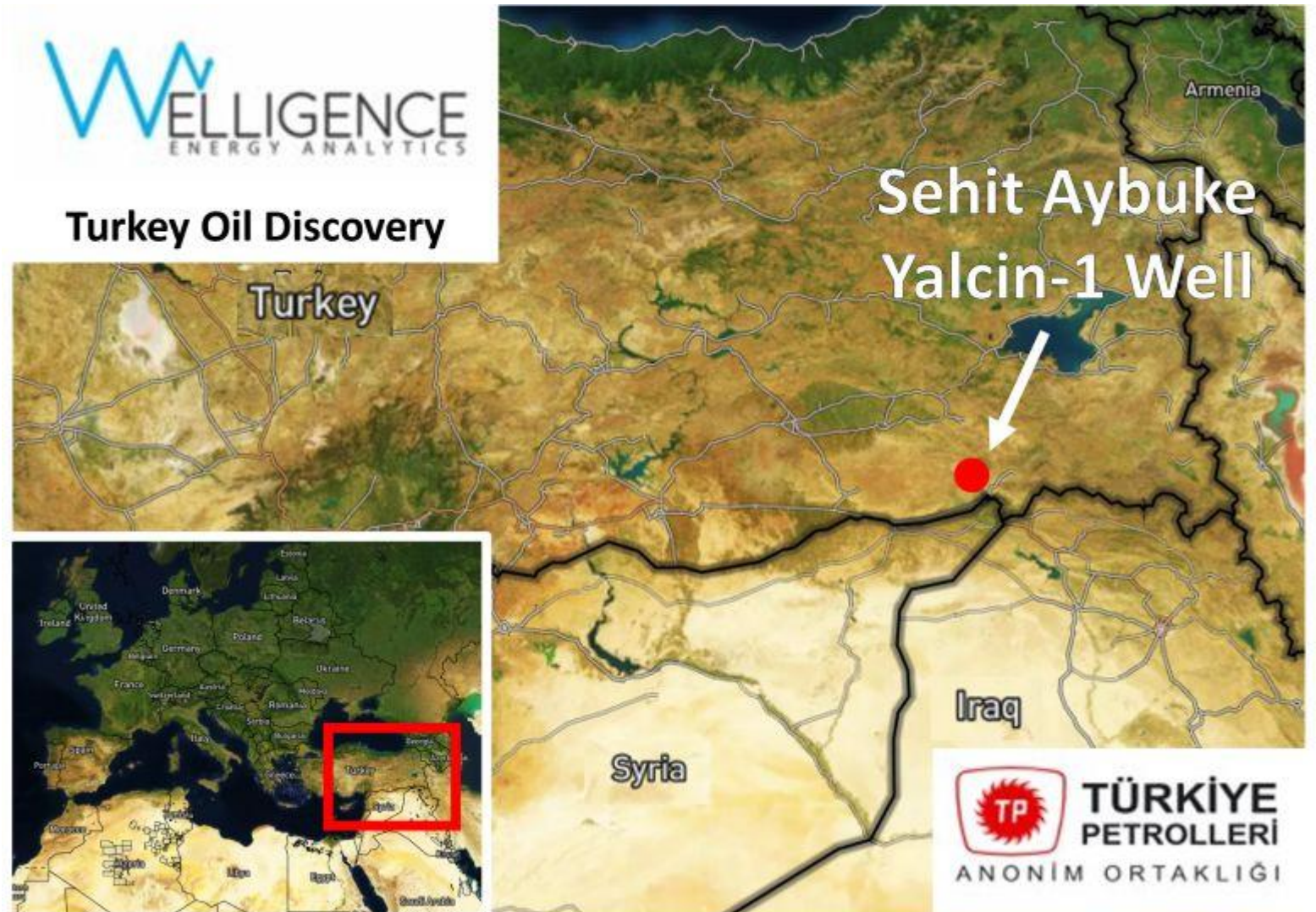
Discovery at Sehit Aybuke Yalcin-1 well drilled by TPAO- SE Turkey

162 m gross oil pay  
Top reservoir : 2770 m  
High flow rate at DST : 10000 bopd  
41°API oil  
Fractured Cretaceous Carbonates

36 km2 folded structure

1 Gbo OIP / 350 Mbo reserves ?

Production forecast : 100 Kbopd



# Egypt : East Med discovery :Nargis by Chevron/Eni

Nargis 1 WD: 300 m/ TD : 5000 m+  
Chevron (45%) , ENI(45%), Tharwa (10%)

60 m Oligocene + Miocene sandstones net  
gas pay

Reserves : 3 Tcf / dry gas ? HP ?



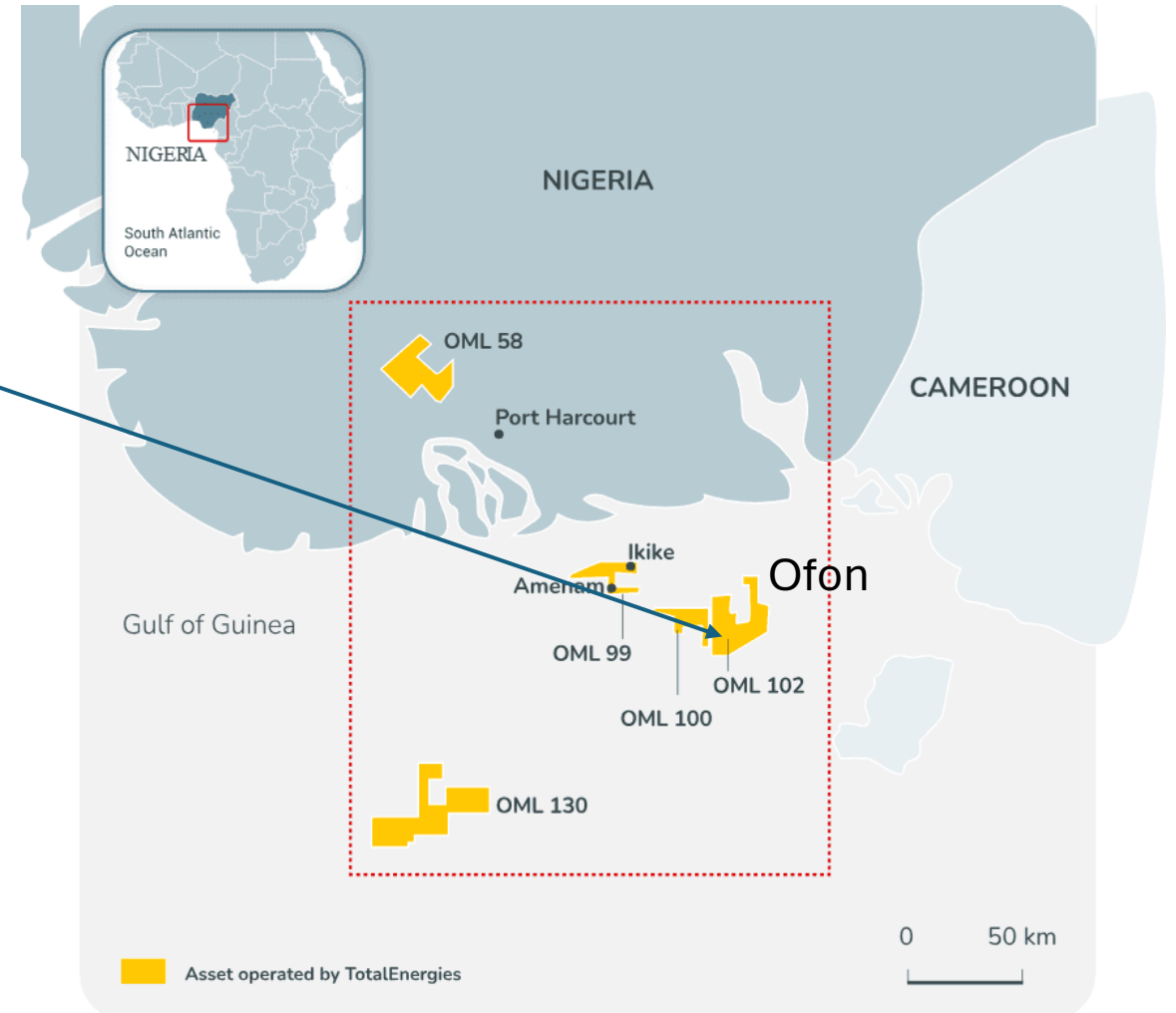


# TotalEnergies success in Nigeria

TEPNigeria, op 40 % and NNPC, 60 %  
Ntokon 1A and 1G discovery  
in the « old » OML 102 license  
33 m net oil sand in well 1A and 75 m  
in well 1G

Excellent DST 5000 bopd 40°API oil  
Close to OFON field : 20 km tie-back

2P reserves : 300 Mbo



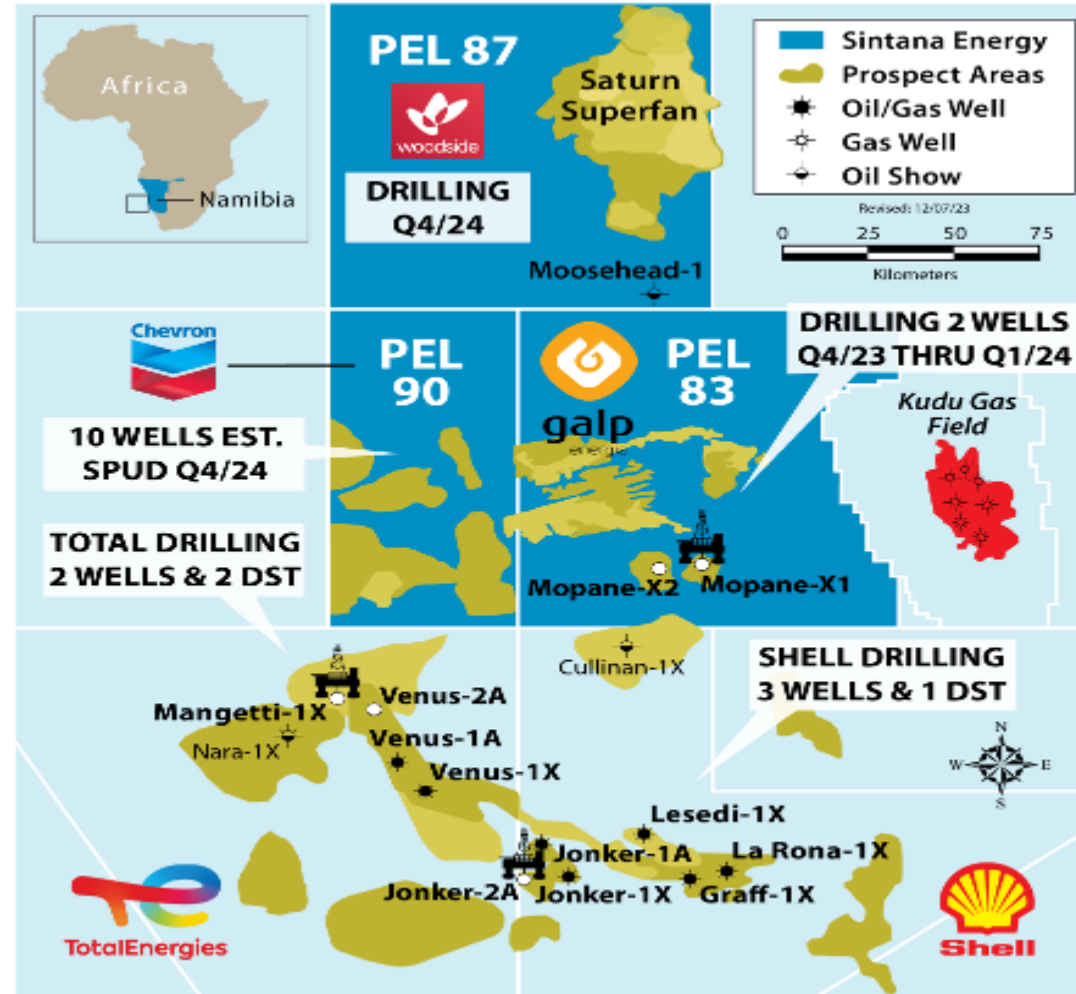


# Namibia : Orange Basin hot spot : Jonker 1 in 2023 and Mopane-1 in 2024

Jonker 1 : Shell op 45%, Qatar Energy 45%,  
 Namcor 10%,  
 WD: 2210 m/TD : 6168m  
 Appraisal Jonker 2 spud in Decembre 2023

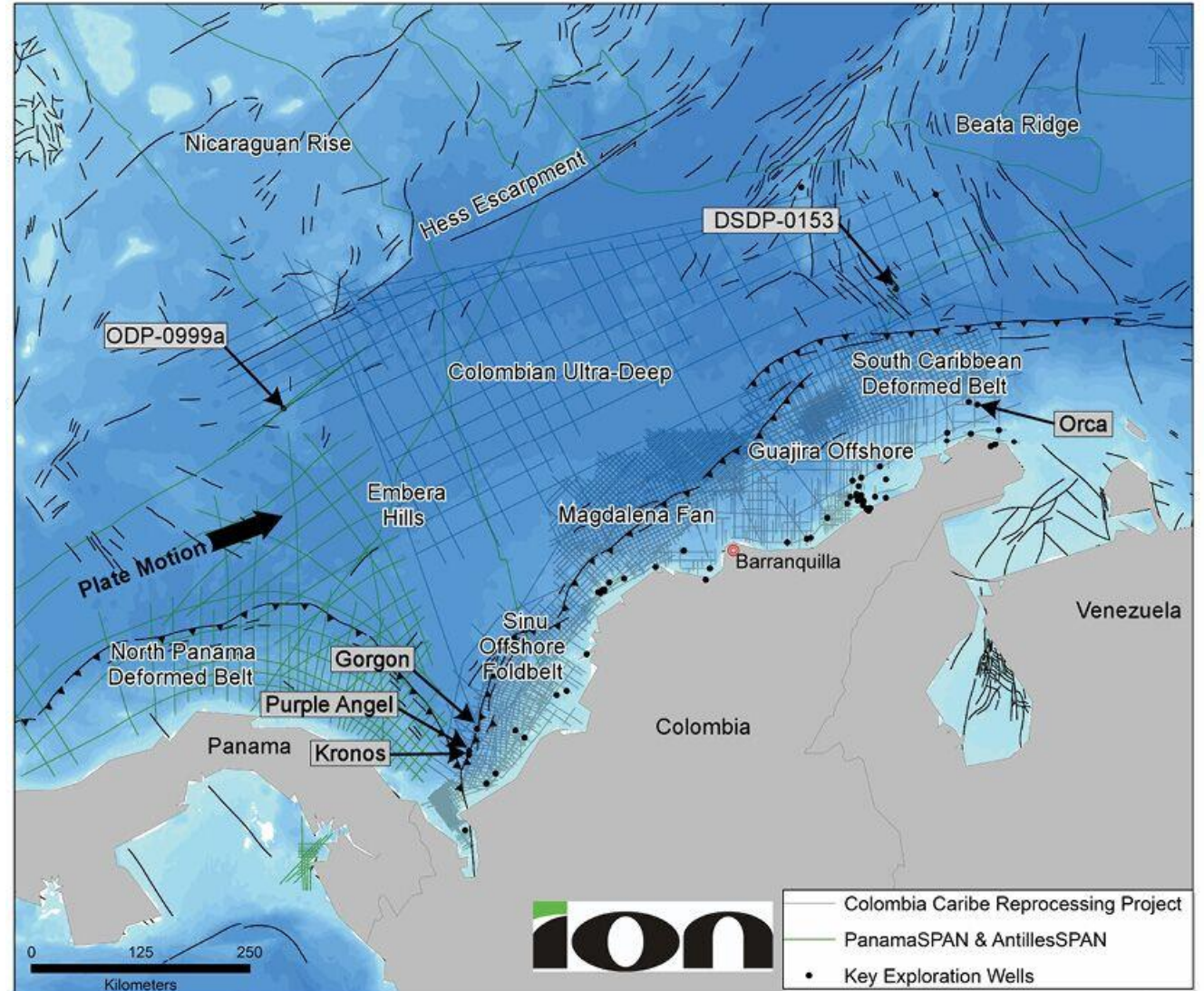
Deep discussions about the recovery factor  
 (low permeability\*illitisation)  
 At least 300 Mbo reoverable

Mopane 1 : GALP op 80%?



# Colombia : New gas discovery deep offshore

After Gorgon 2 appraisal in 2022  
Shell op, 50 % and Ecopetrol  
50% made a discovery in  
**Glaucus 1** in block COL-5  
WD : 2340 m /TD : 4284 m  
Gas discovery ;several Tcf ?

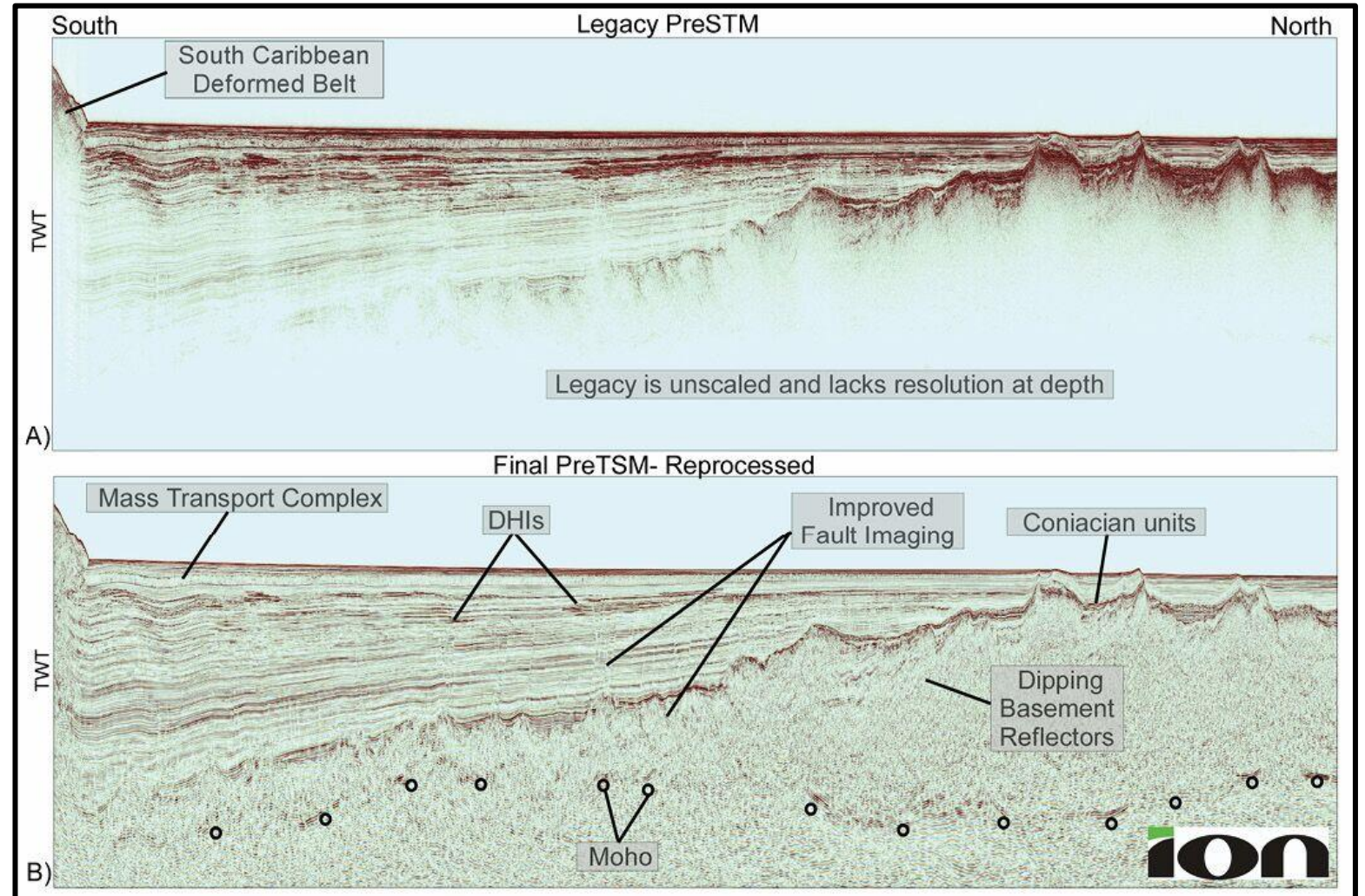




# Colombia : New gas discovery deep offshore

North of Panama and  
Colombia Thrust and Faults  
Belts  
Upper Mesozoic and  
Cenozoic deposits

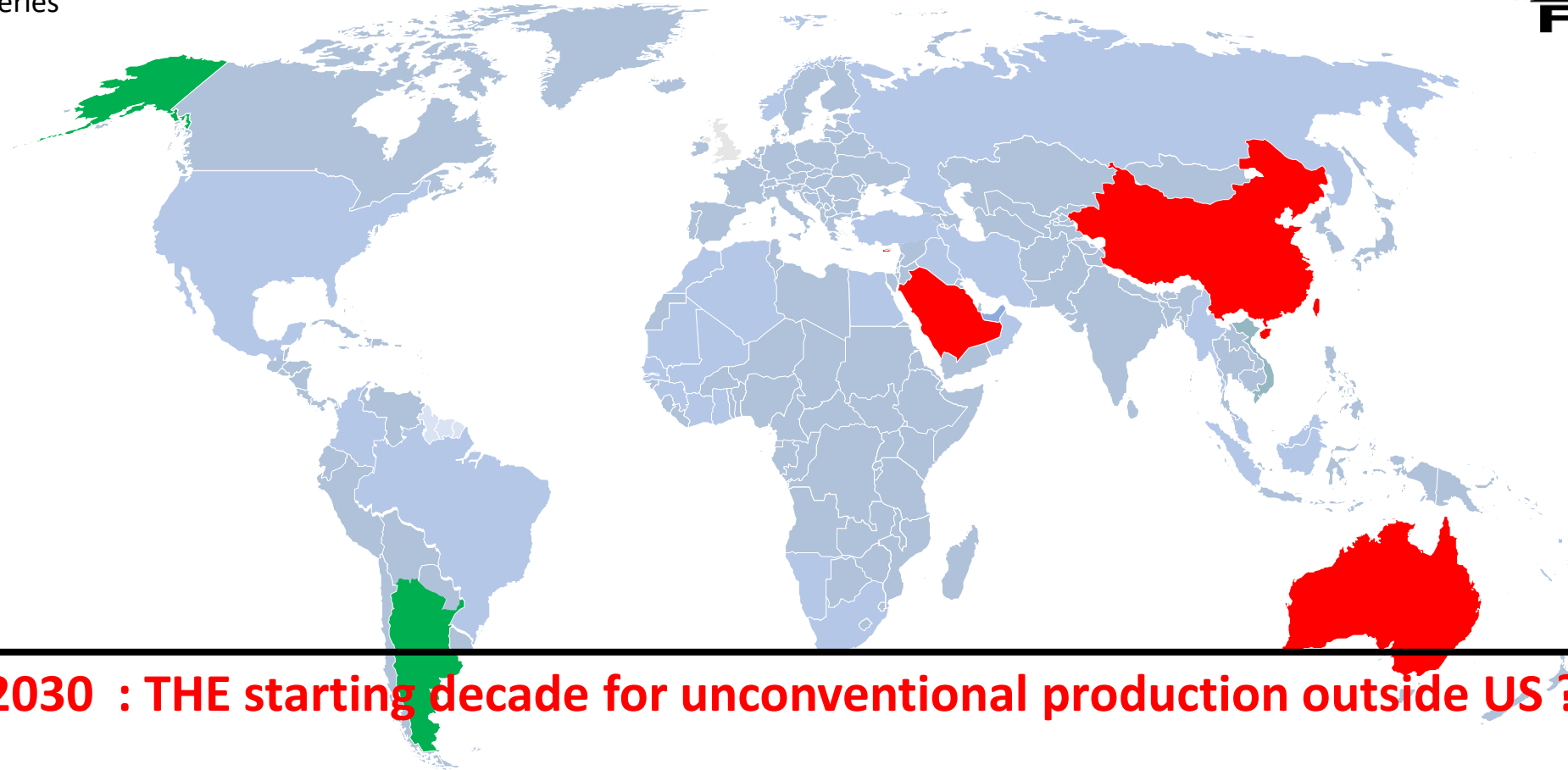
Origin of gas : biogenic (very  
dry gas) or thermogenic (La  
Luna UK source-rock ?)  
deeply buried below TFB ?



## 2023 Unconventional HIGHLIGHTS



- OIL and
- GAS Discoveries



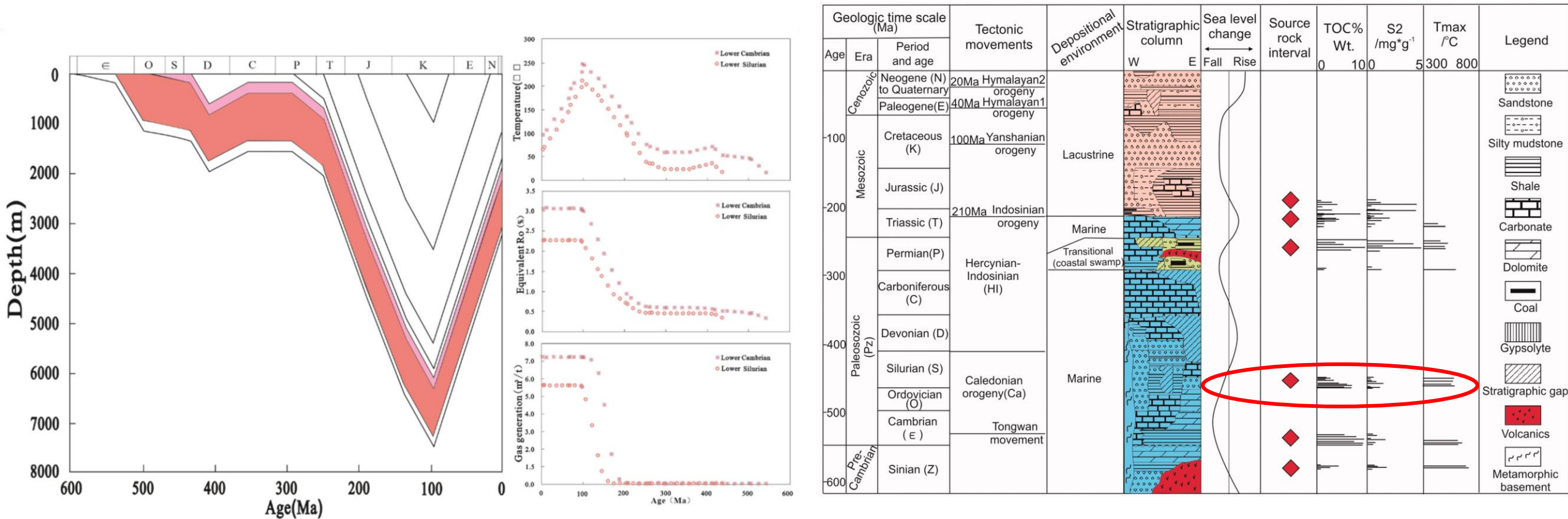
**2020-2030 : THE starting decade for unconventional production outside US ?**

**Shale Oil /LTO : Argentina, Alaska**

**Shale Gas : China, Saudi Arabia, Australia**



# China Sichuan Shale gas exploration



Main gas shale is Ordovician-Silurian marine black siliceous shales ( Wufeng and Longmaxi Fm) : thick to very thick (50 to 200 m at +2% COT), overpressured (1,3 to 2) It underwent huge inversion (Himalayan Collision) in UK/Tertiary

# China Sichuan Shale gas production

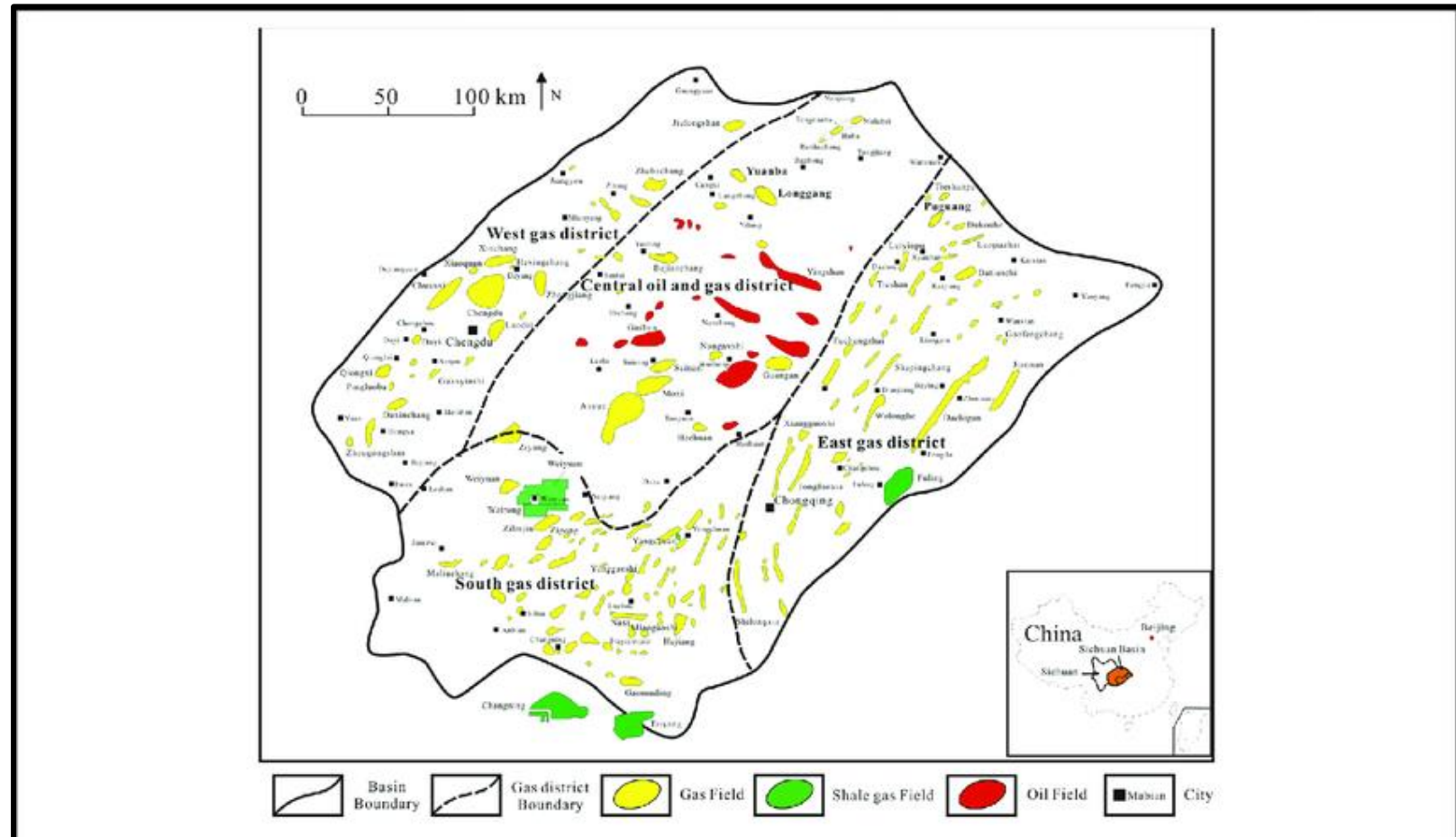
Three main (extremely dry) gas shale fields discovered by SINOPEC :

-**Fuling 2012** ;30 Gm<sup>3</sup> reserves/  
400 wells/ 200 km<sup>3</sup>/d average deliverability by well

-**Weirong (Weiyan) 2020**; 100 Gm<sup>3</sup> ; 3Gm<sup>3</sup>/y in 2024

-**Changning 2011** : 6,5 Gm<sup>3</sup>/y but numerous HF-induced earthquakes

What next ? : in 2022 , Jinshi 103HF exploratory well yielded a gas production of 260 kcm<sup>3</sup>/d is the first commercial discovery in the Cambrian Qiongzhusi Formation



# Saudia Arabia :Jafurah liquid Gas shale play

Resources : 230 Tcf and 75 Gb (Cd+NGL) (February 2024)

East of Ghawar:

**Tuwaiq Mountain Fm :**

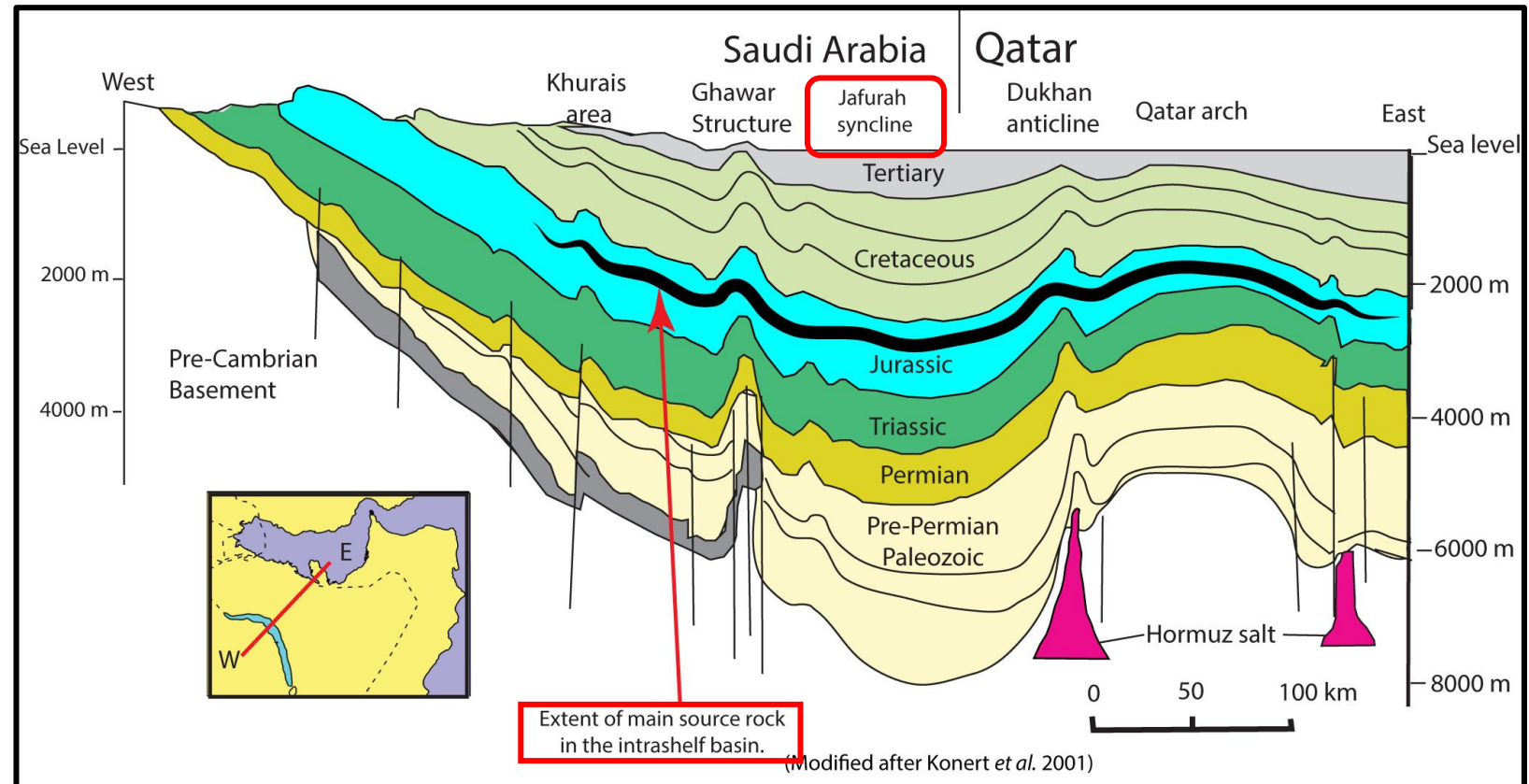
Callovo-Oxfordian Jurassic marls (17000 km<sup>2</sup> extension/2500 m depth)

**Production strategy different from the US gas shales :**

Hundreds of H drilling/tests completed since 2011 (discovery date ?)

First gas 2024/2025 ?

**Peak : 6 bcf/d +500 kbcpd (Cd/NGL/C2)**

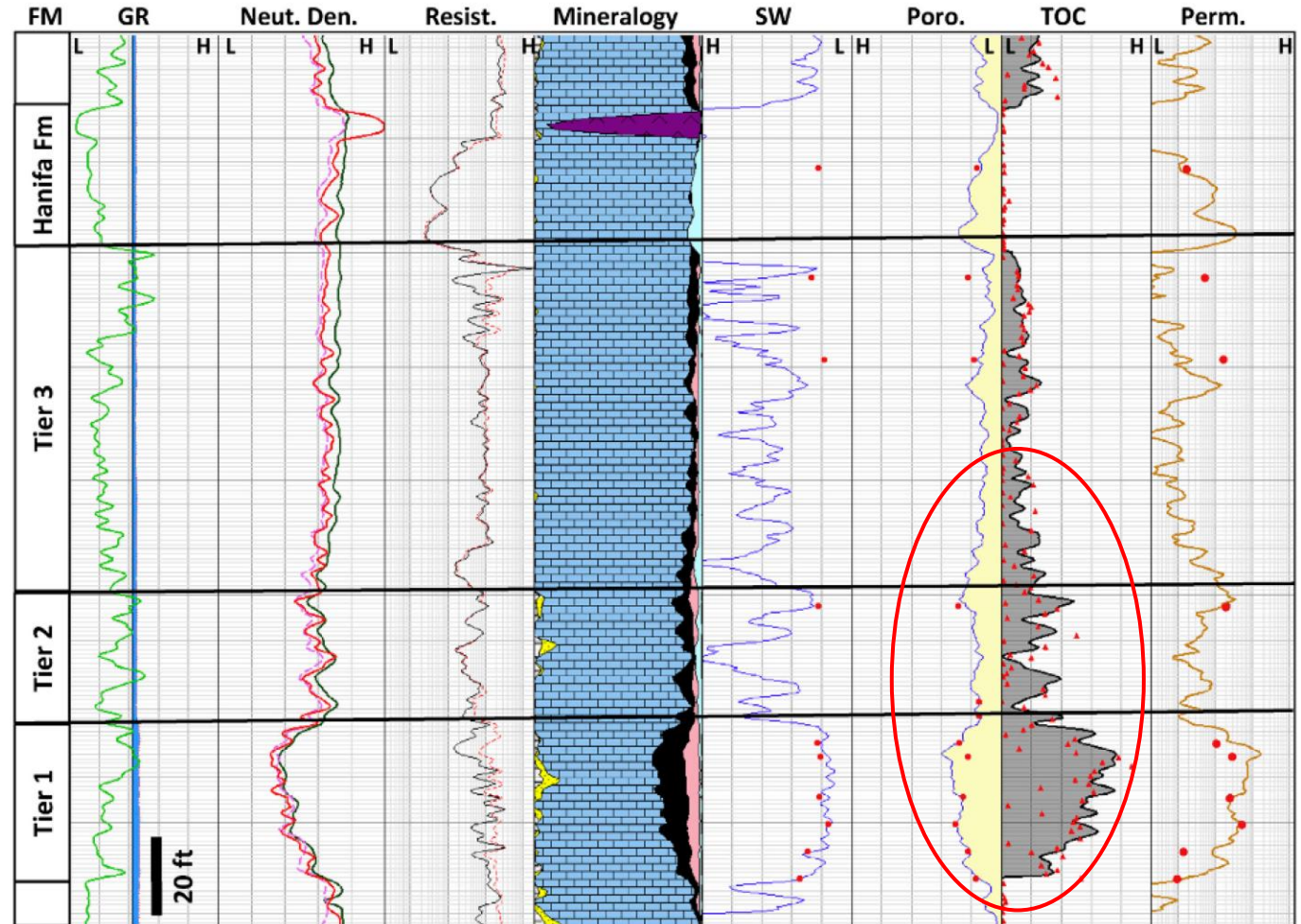




# Saudia Arabia :Jafurah liquid Gas shale play

## Tuwaiq Mountain Fm Source-rock characterization:

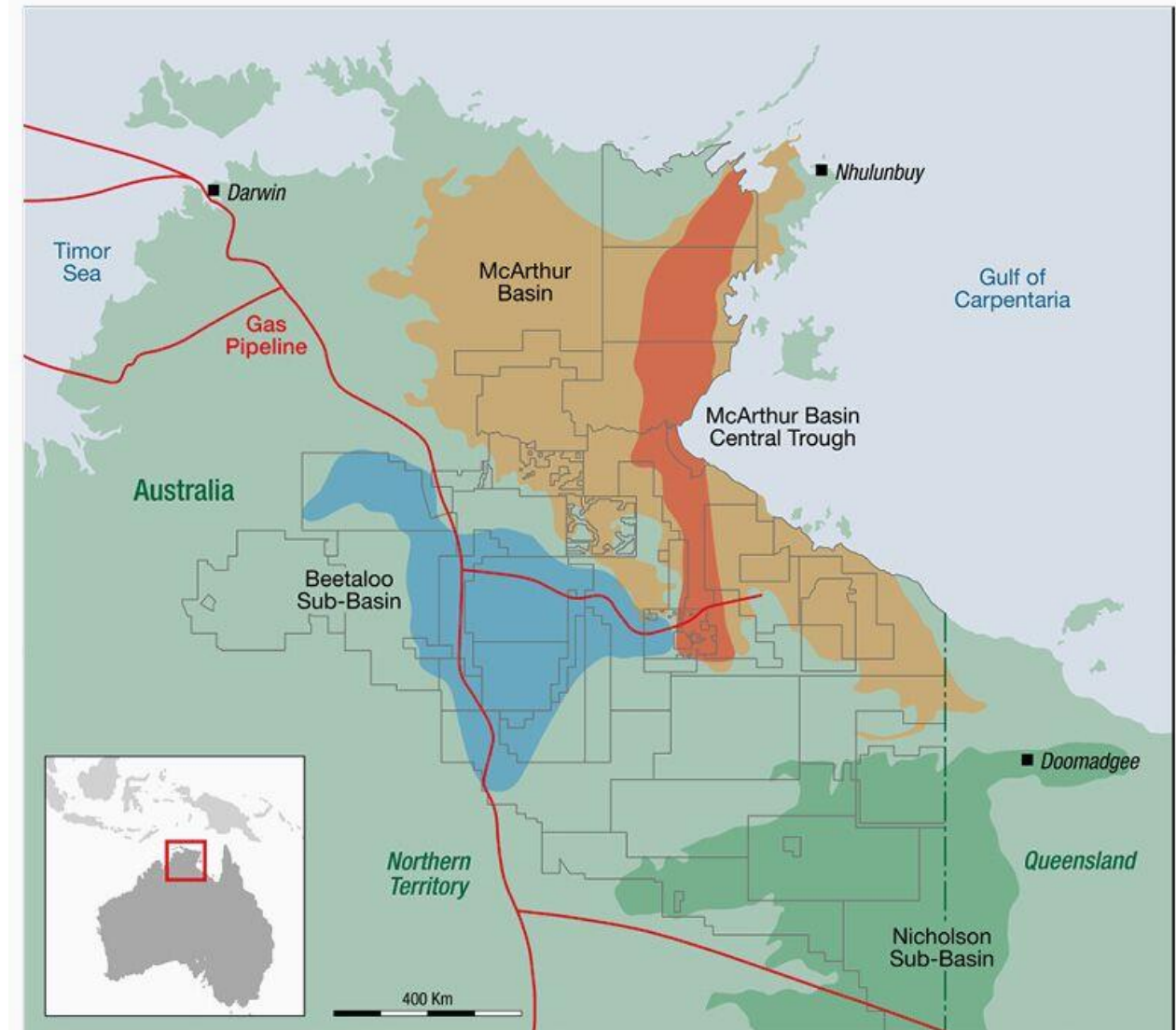
- Eagle Ford like liquid rich gas
- 200 feet shale thickness
- 0,9 to 1,3 VRo window,
- 3 to 7 % TOC,
- **S1 = 5** and S2 = 5 mg HC/g rock
- Intense Micro-fracture
- Overpressure** (1psi/ft)
- 84 to 90 % Calcite+Dolomite





# Australia Beetaloo Basin : oldest worldwide Shale gas

Main target is the excellent organic rich siliceous mustone Velkerri Fm (1,4 Gy) of the Ropers Group : age doesn't matter Jean ! But water does !

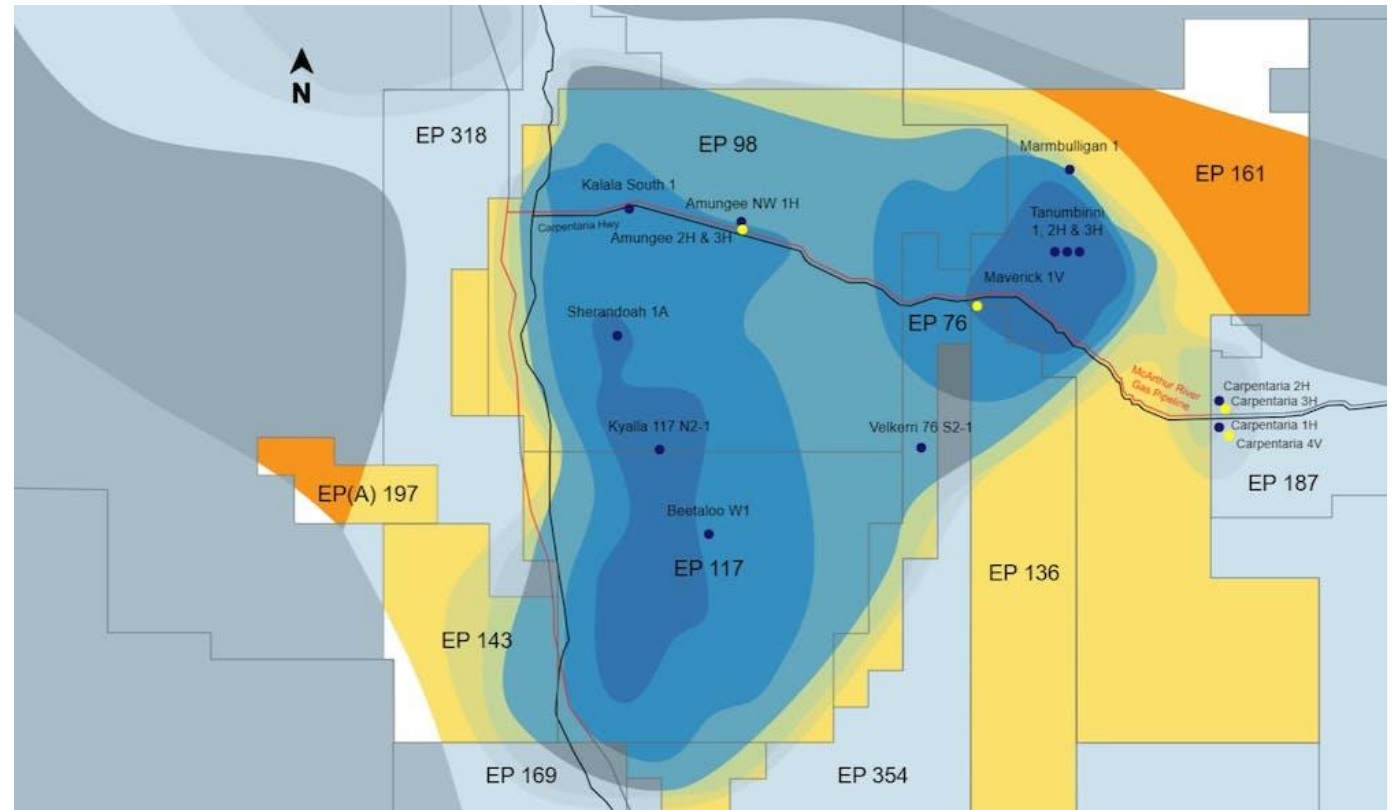


# First results in Betaloo Basin

1-In EP 187 block , Empire Energy drilled Carpentaria 3 horizontal test and produced 3,3 Mscf/d,  
Audited reserves : 50 Gm3

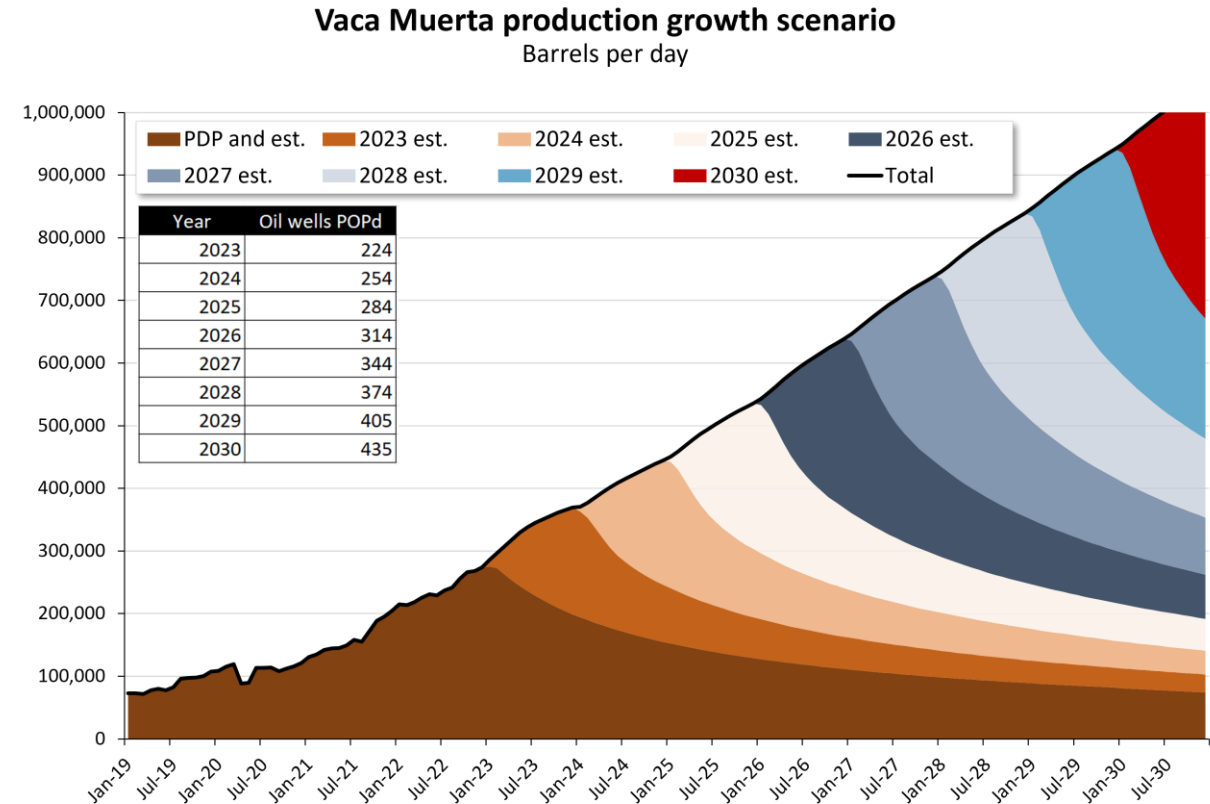
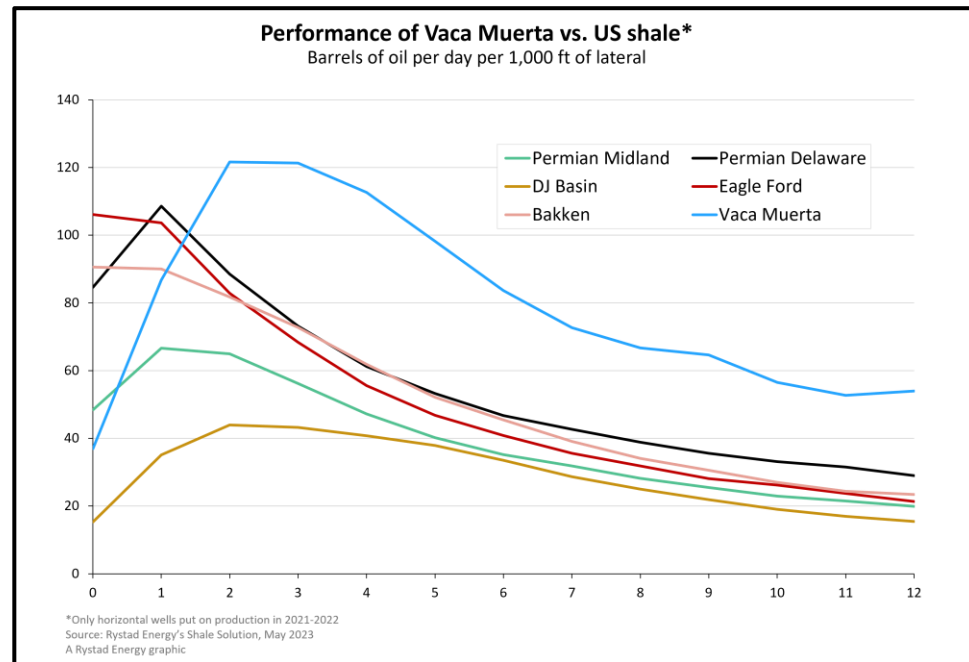
2-In EP 98 block, Origin 70% and Falcon 30 % tested  
-Amungee NW-1 Horizontal well (1000 m lateral/ 10 frac stages) and produced 1,5 Mscf/d  
-Amungee NW-3 H

In both block production could start in 2025



# Argentina Vaca Muerta in Neuquen Basin

A steadily production increase : more than 350 kbopd end of 2023  
 2 Bcfd gas as well  
 YPF-Exxon-Shell-Totalenergies-Chevron-Tecpetrol-  
 Forecast 1000 kbopd in 2030 (Rystad scenario-left) thanks to better productivity than US shales



Source: Rystad Energy's Shale Solution, May 2023  
 A Rystad Energy graphic



# Alaska onshore LTO Phoenix project

After Icewine 1 and 2 drilling in 2017 , and testing of Pantheon's operated, horizontal Alkaid 2 wildcat (550 bopd of 40°API) in 2022 , 48 Energy announced a discovery :

**Hickory 1 well** in Slope Fan System/TD : 10650'  
 450 ft net oil pay from 7700 to 10500'; Phi: 8-12 %  
 DST planned for winter 2024  
 Ressources : 1 Gbo

