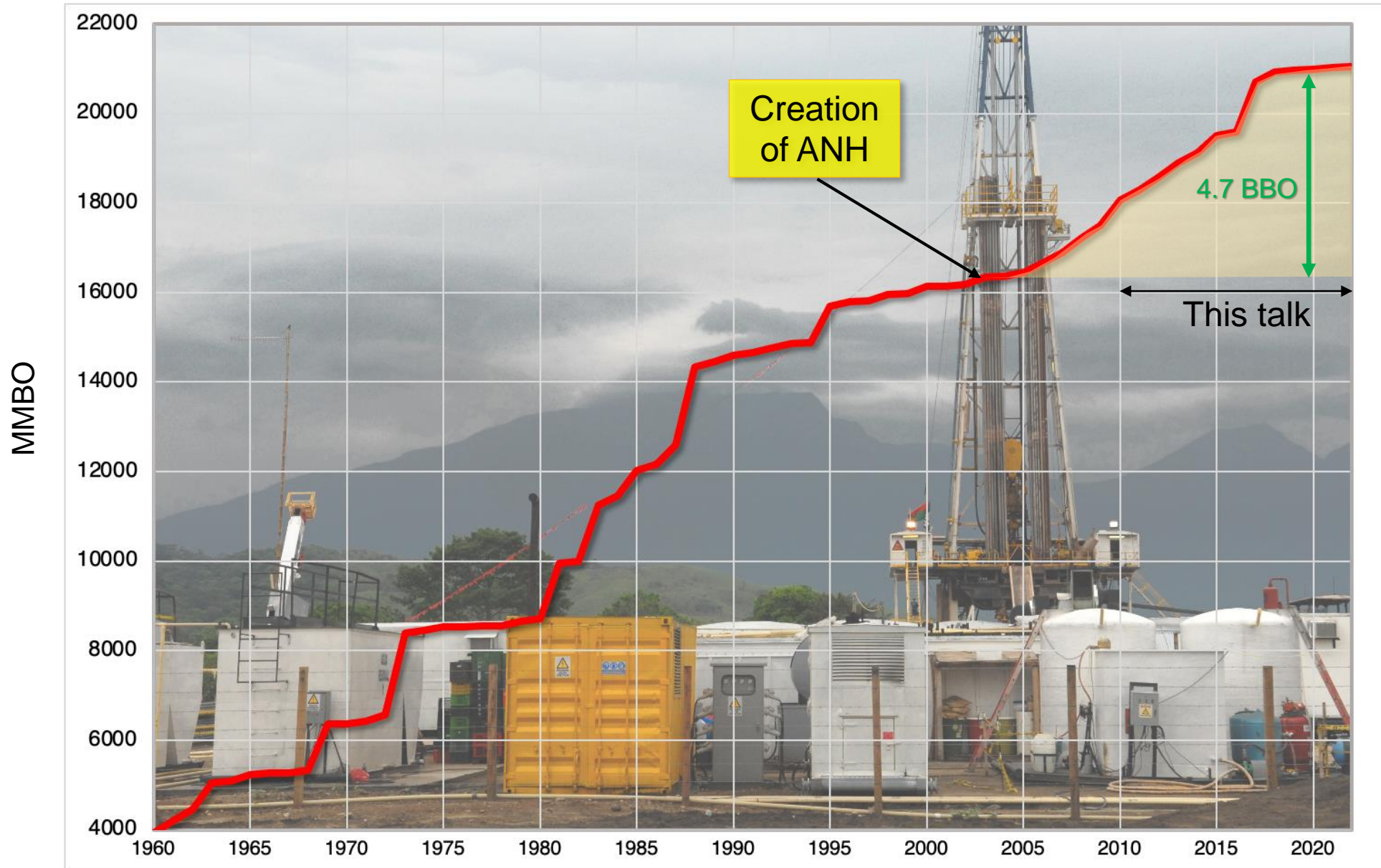


# Exploration Trends and Opportunities in Colombia

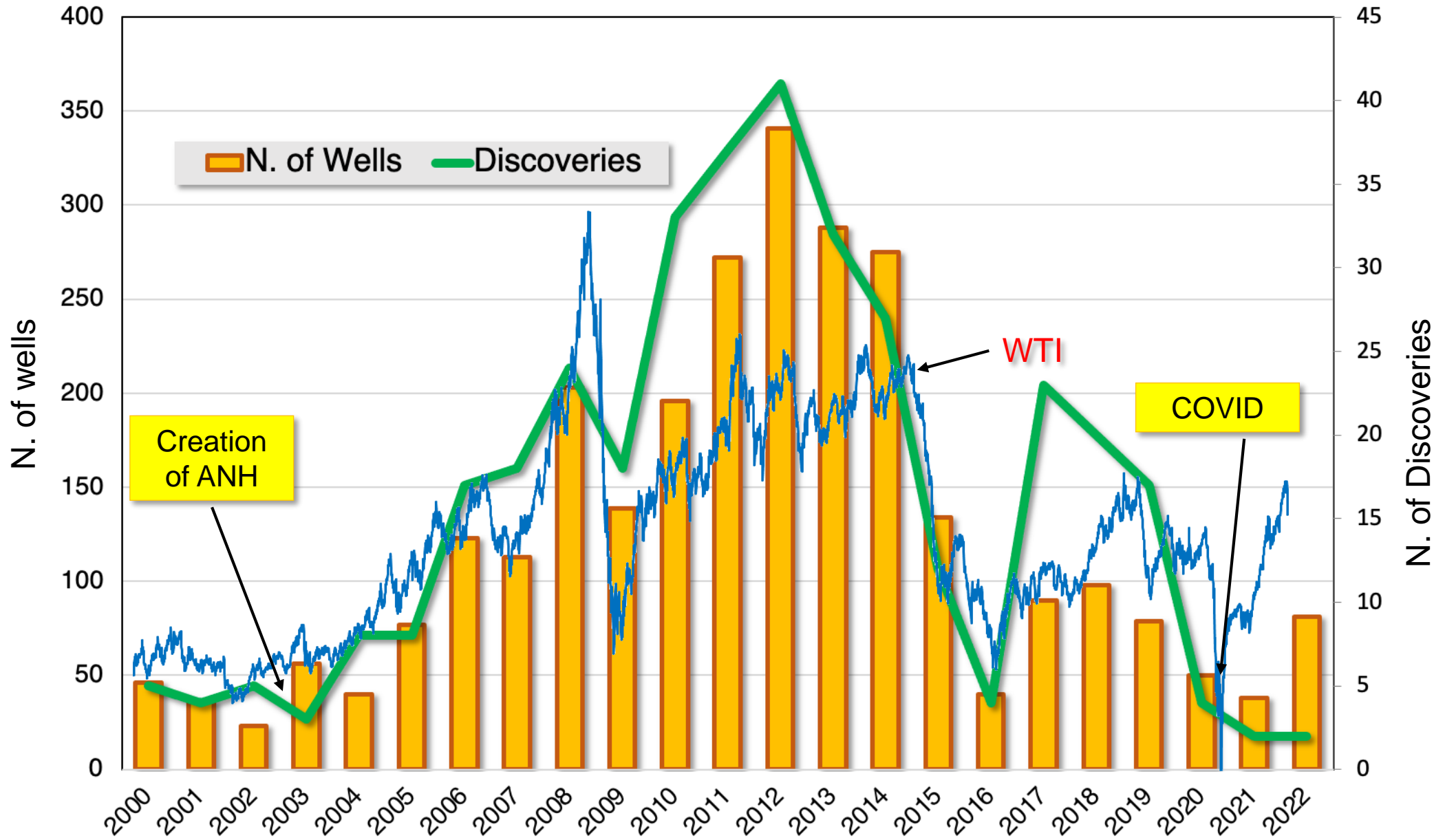
Carlos E. Macellari

ANH Webinar Series, July 15, 2022

# Creaming Curve Colombia

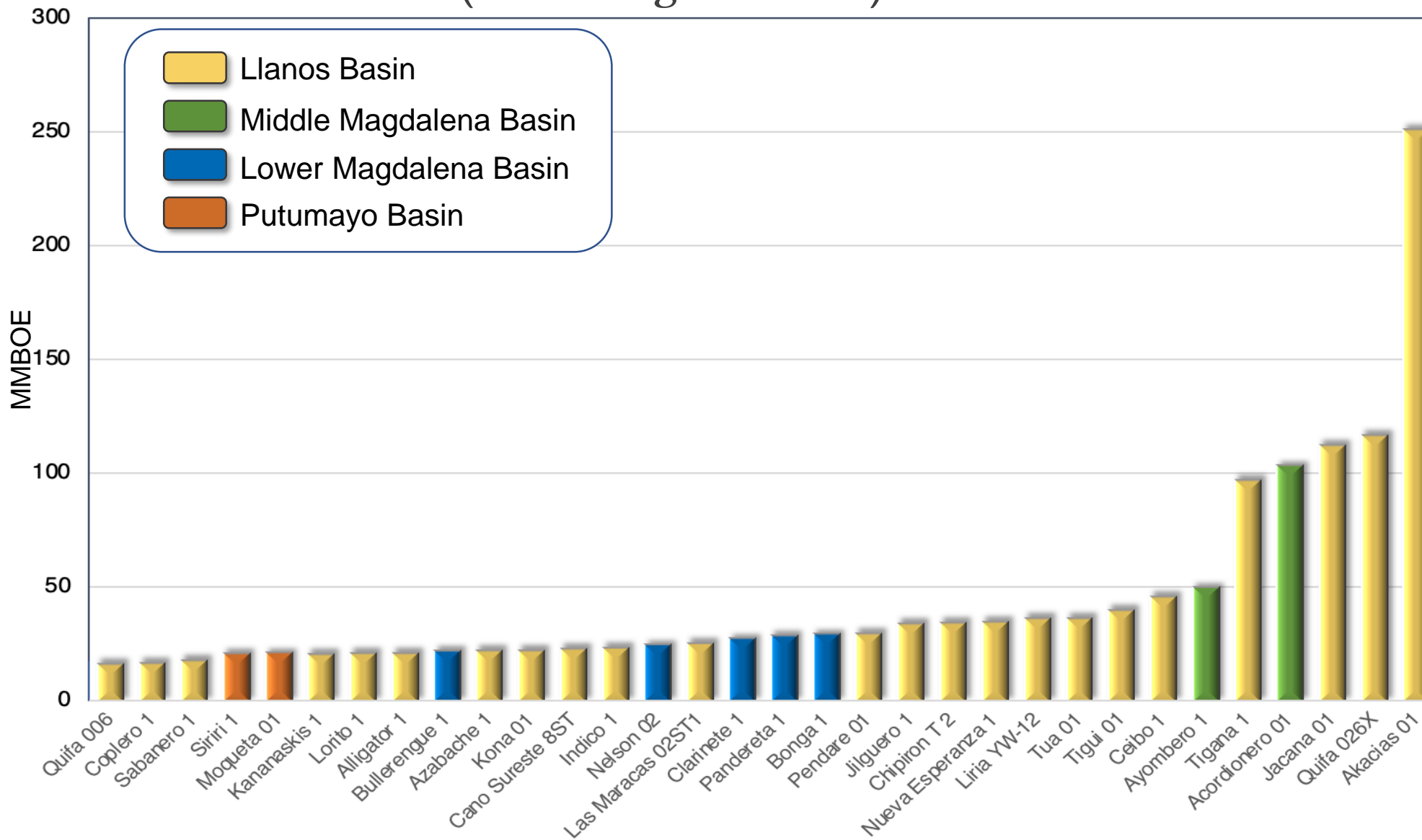


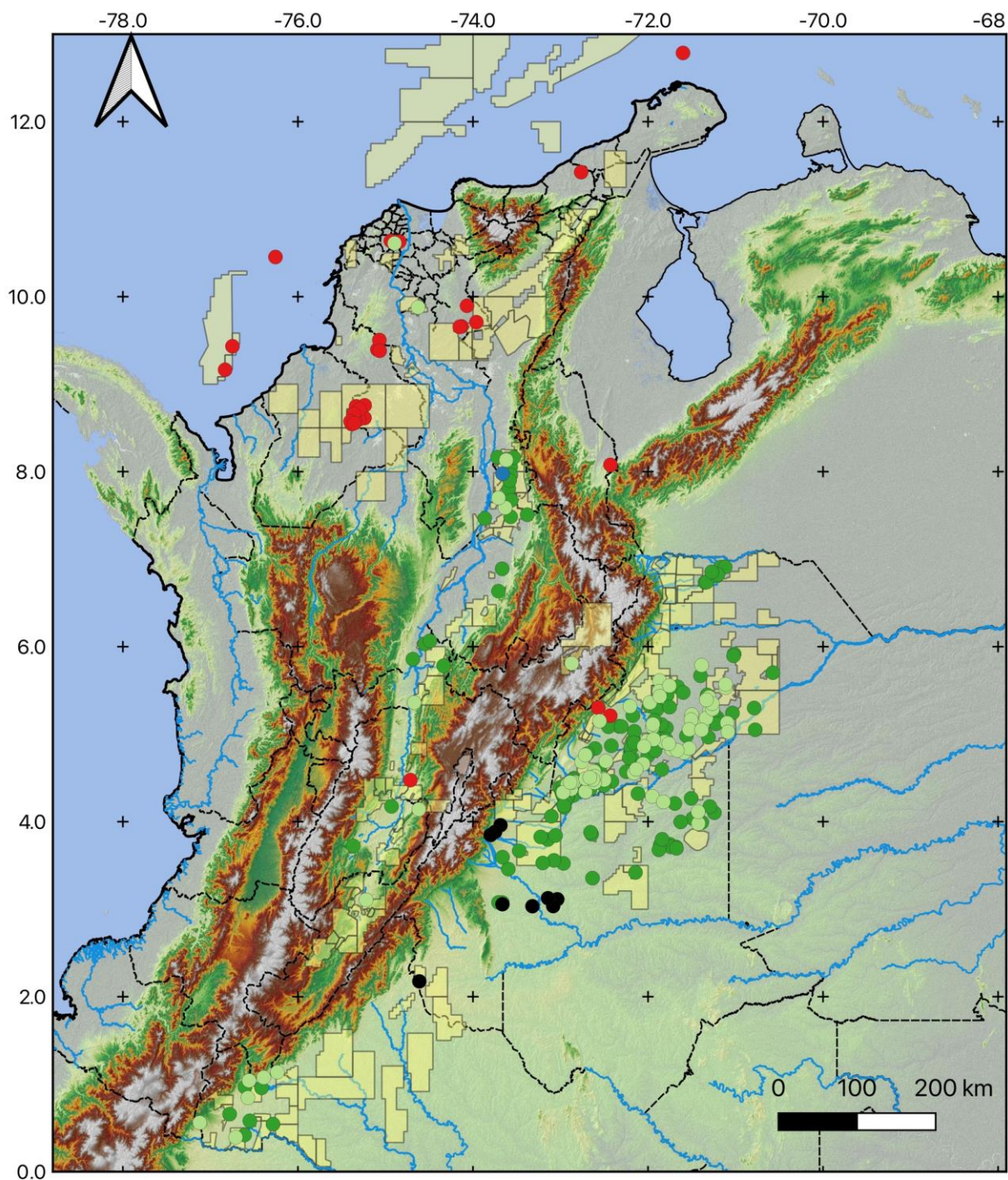
# Discoveries since 2000





(Excluding Offshore)

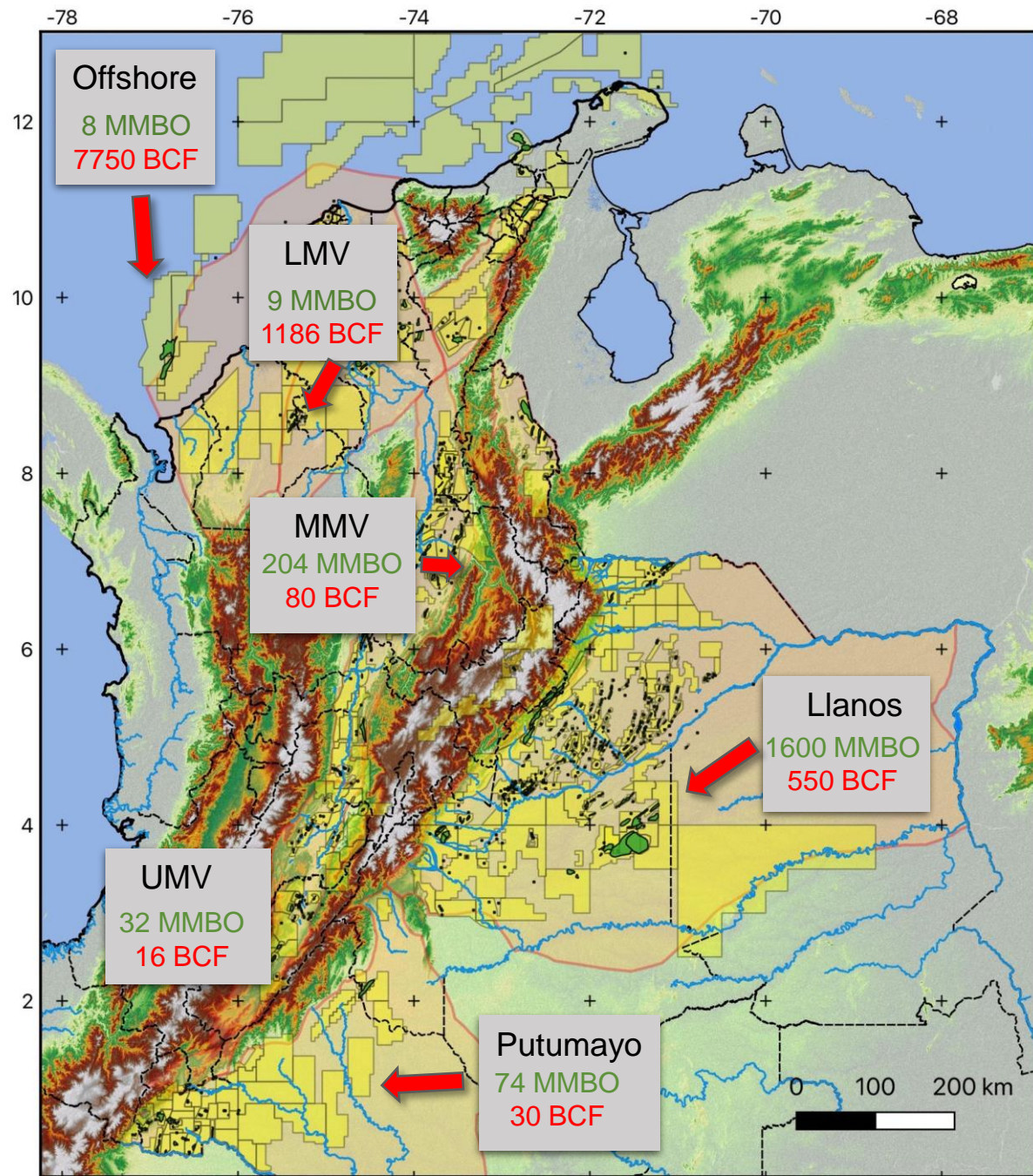




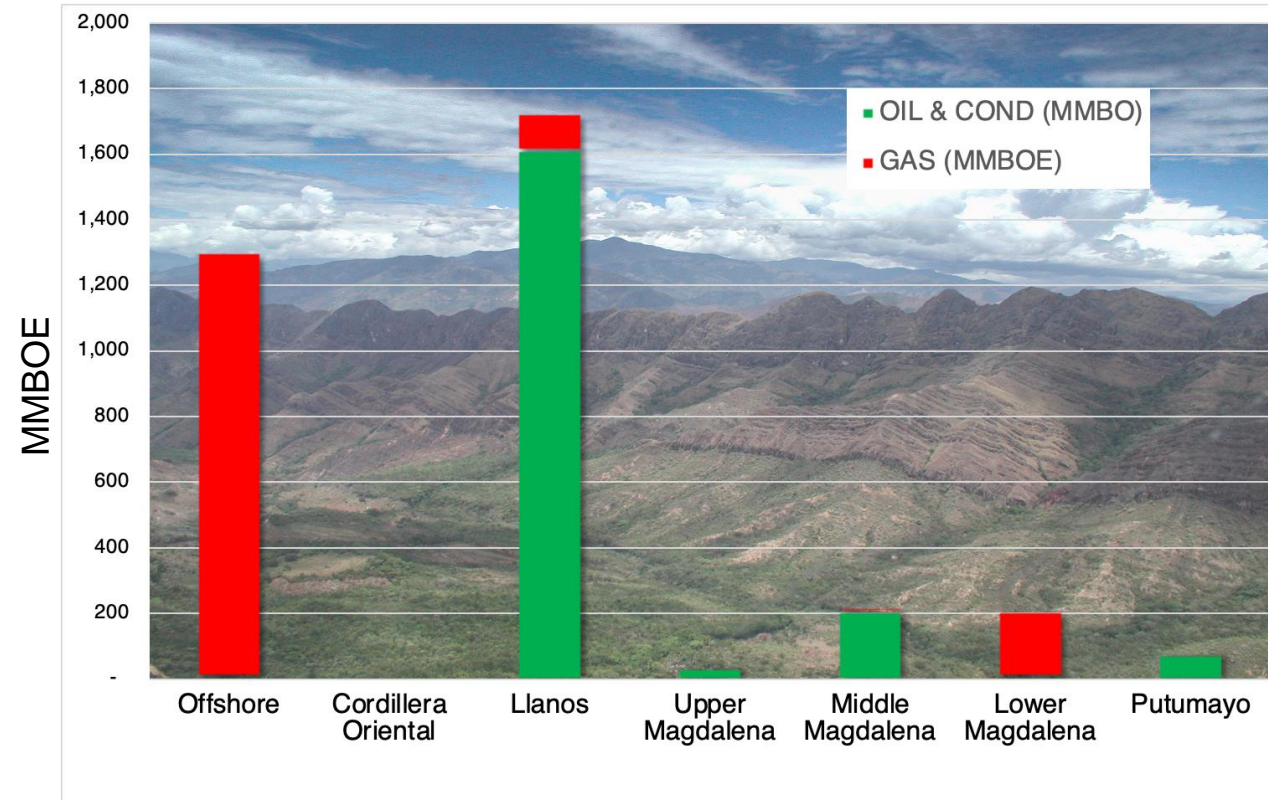
# Discoveries 2010-2022



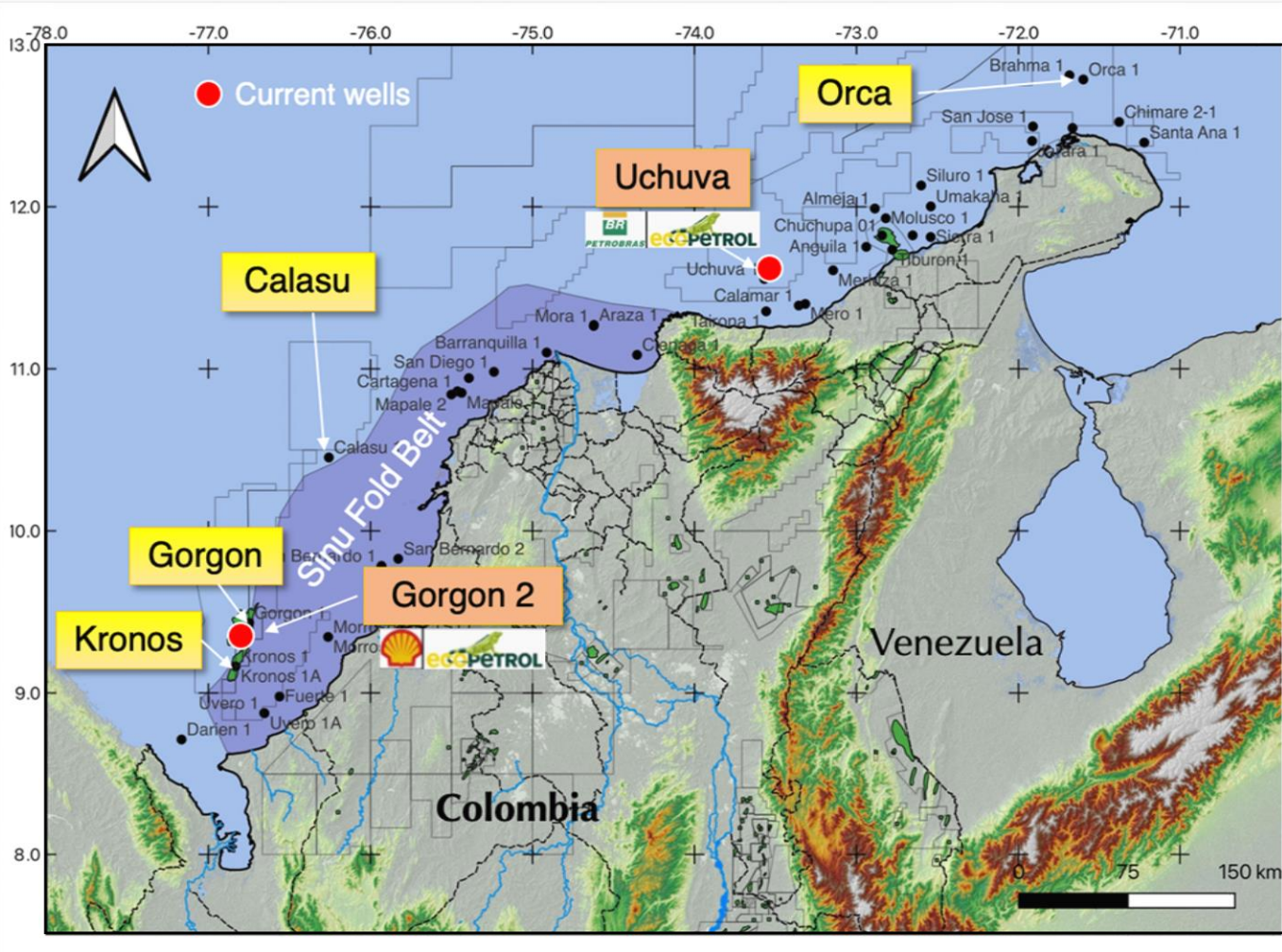
- Gas
- Oil & Gas
- Oil
- Heavy Oil
- Unconventional
- Exploration block signed after 2010



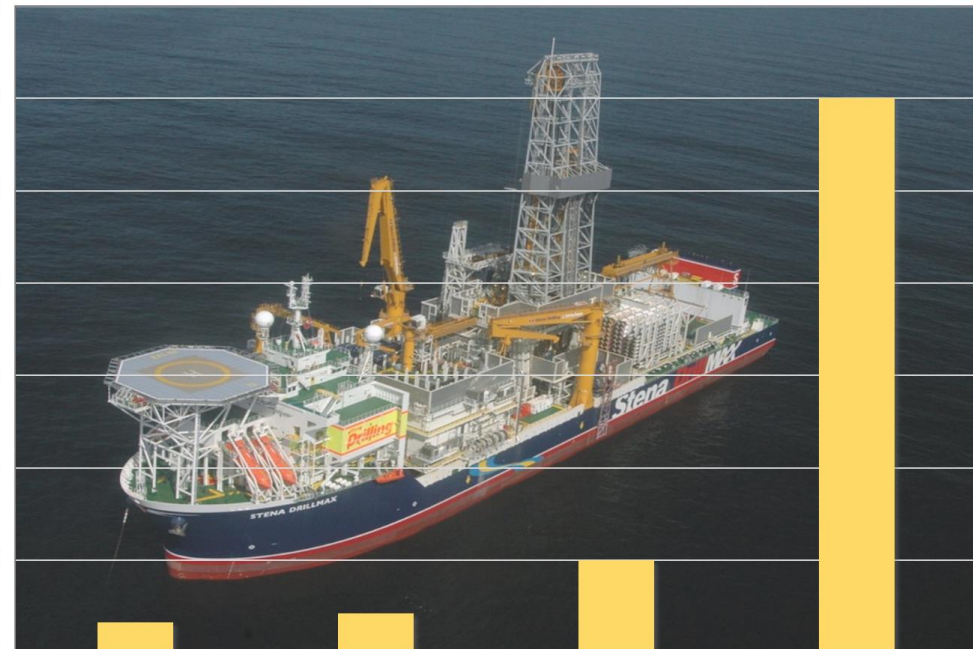
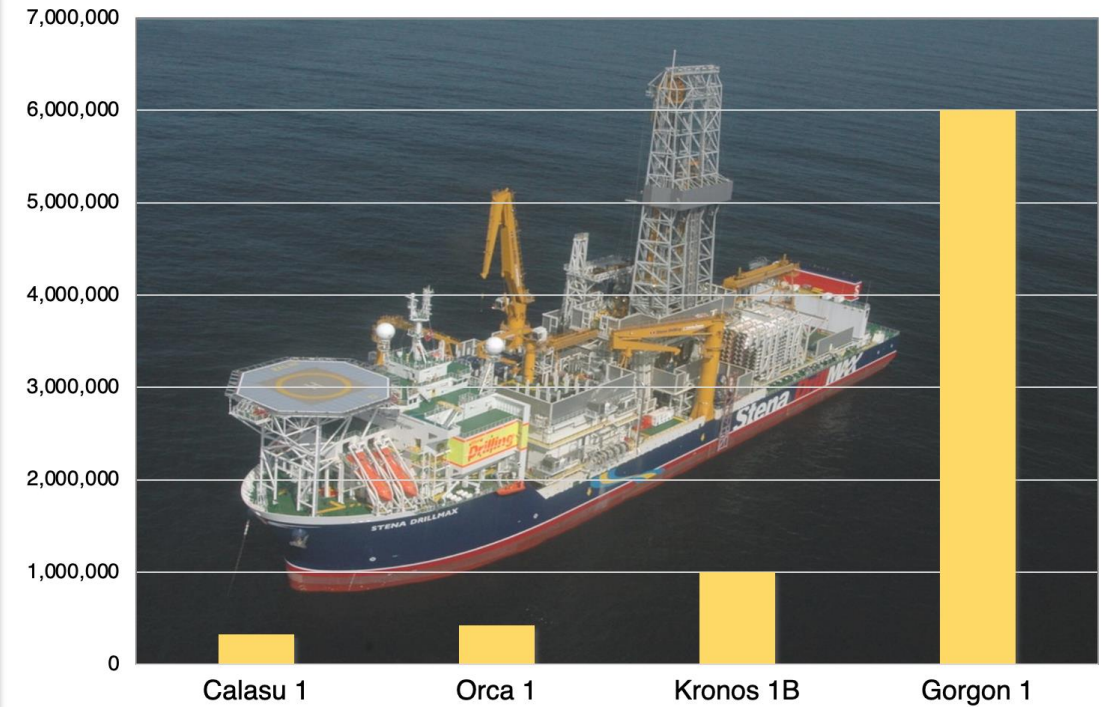
# Discoveries 2010-2022

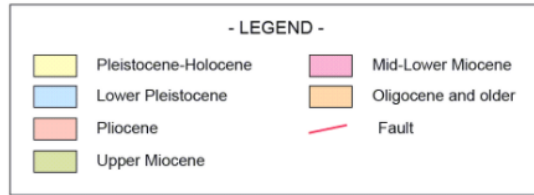


3.5 Bboe

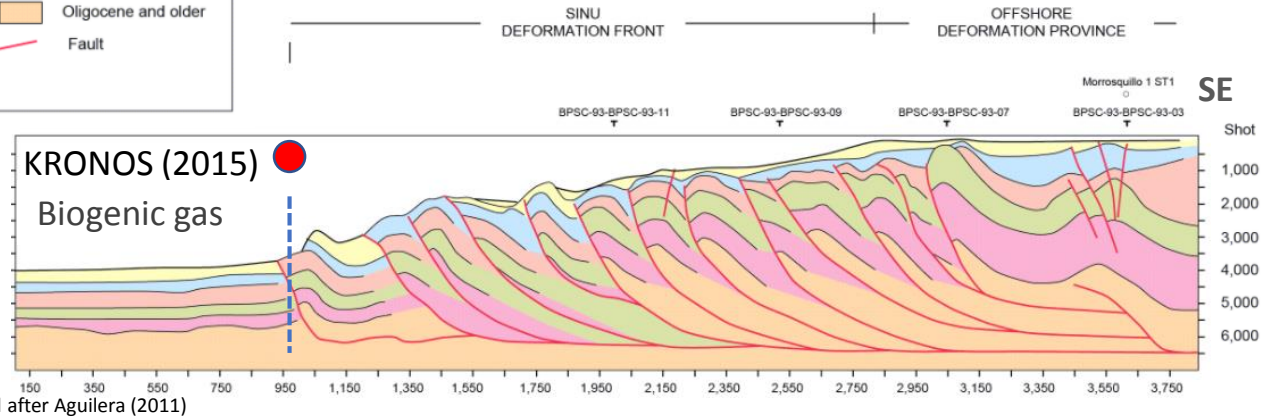


Offshore Discoveries (Mmcf)

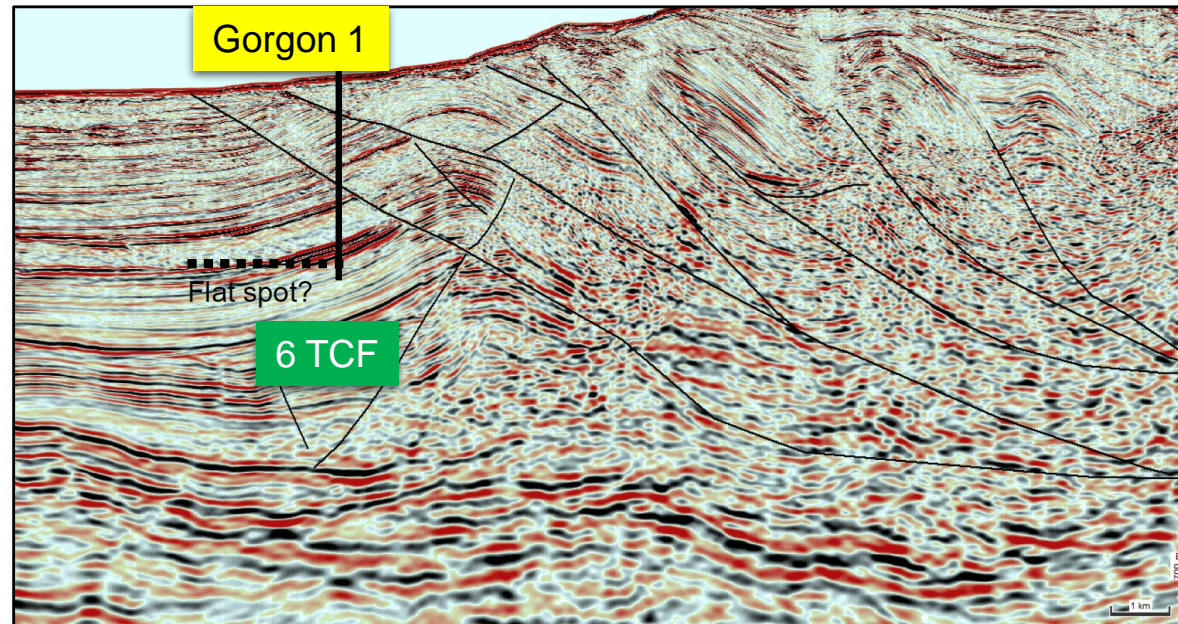




- Biogenic fields in frontal accretionary prism

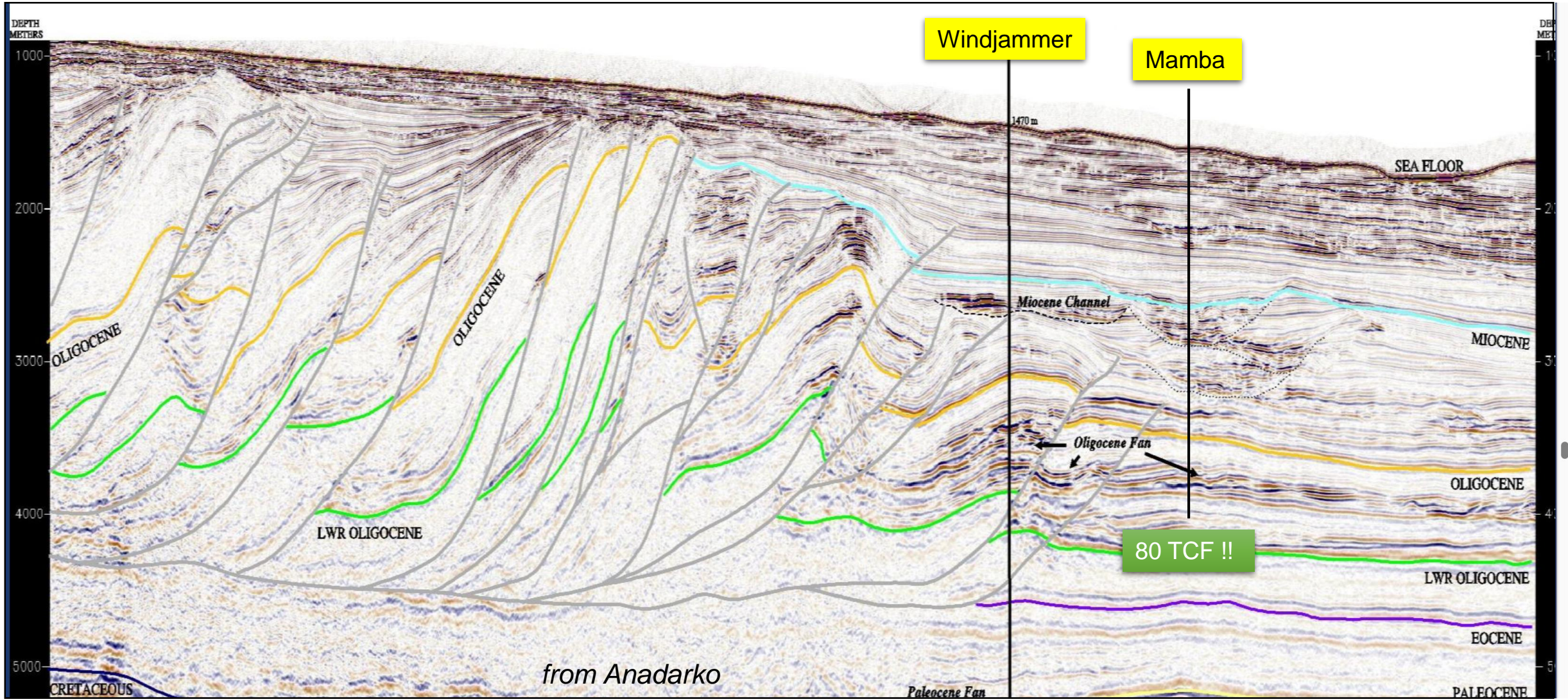


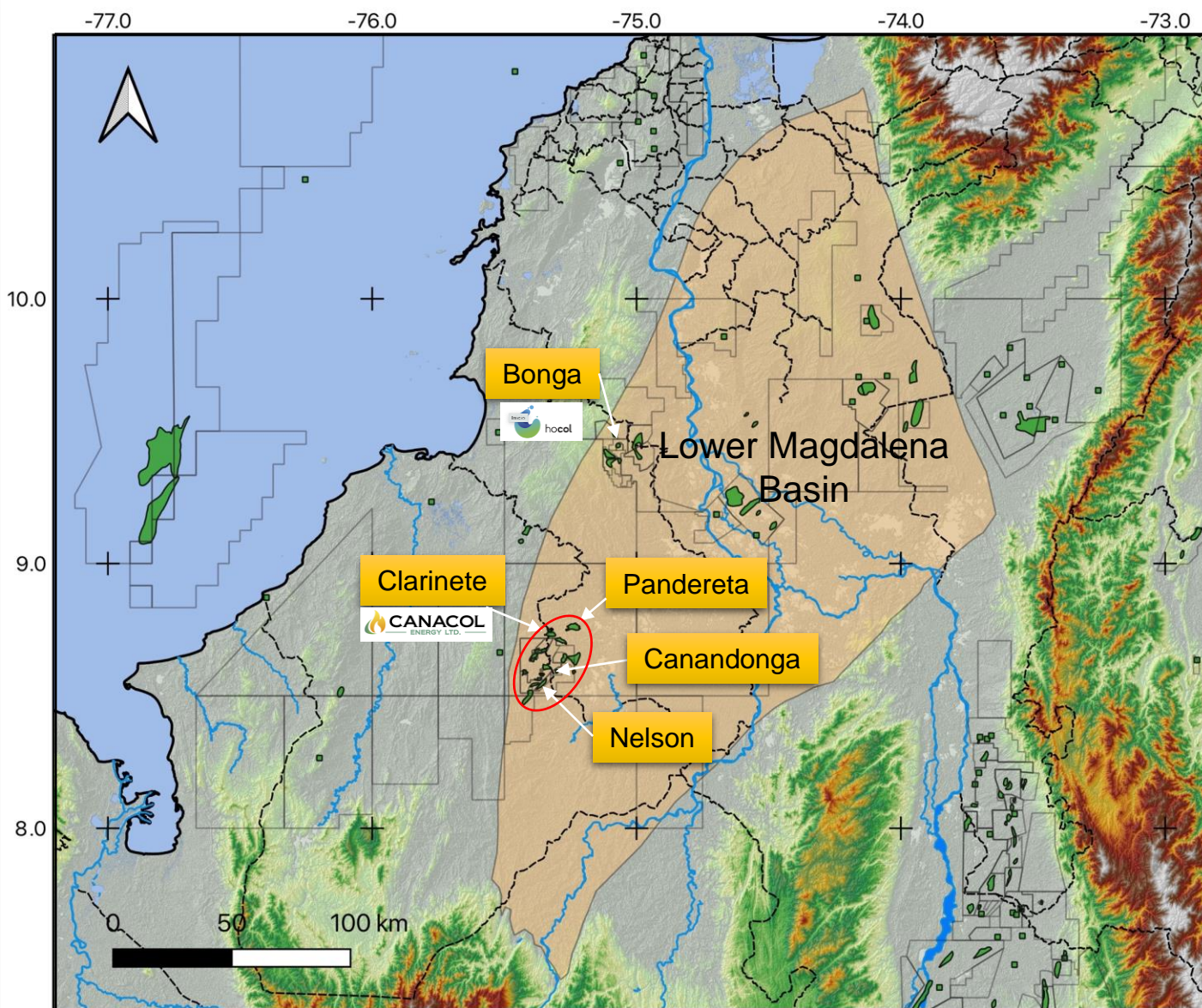
IHS. EDIN, modified after Aguilera (2011)



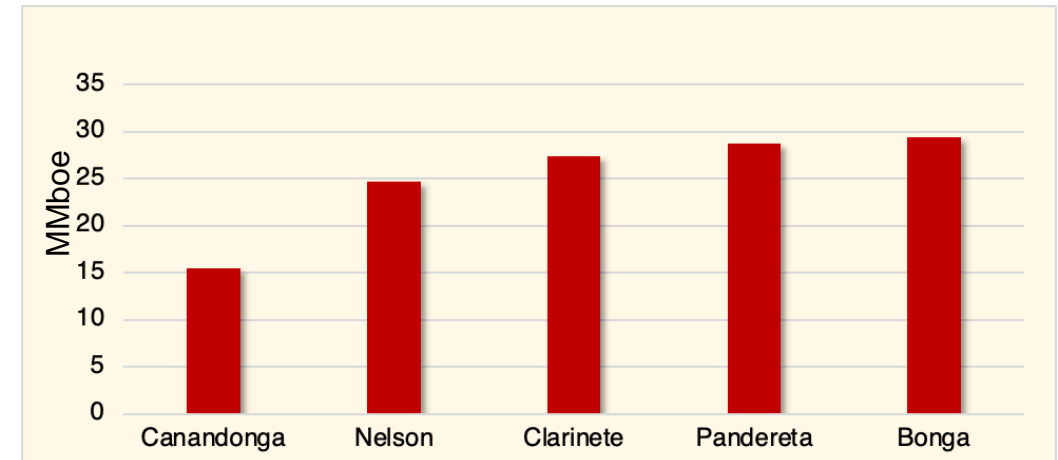
From Goswami et al., 2022

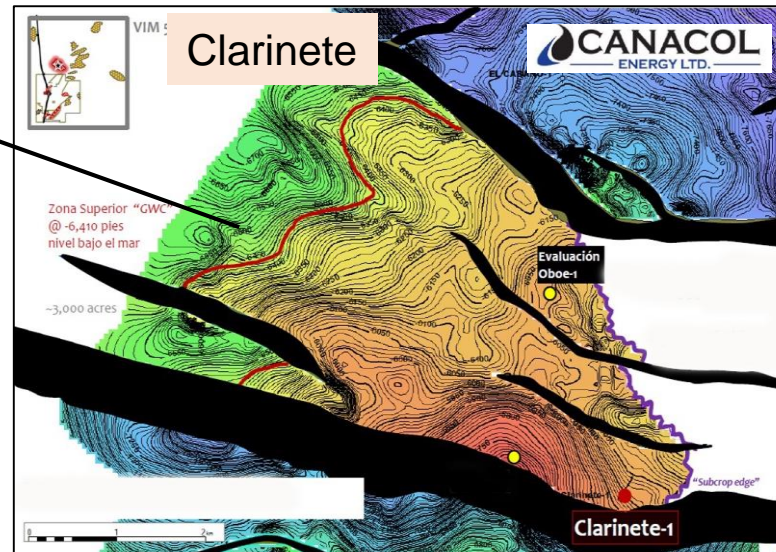
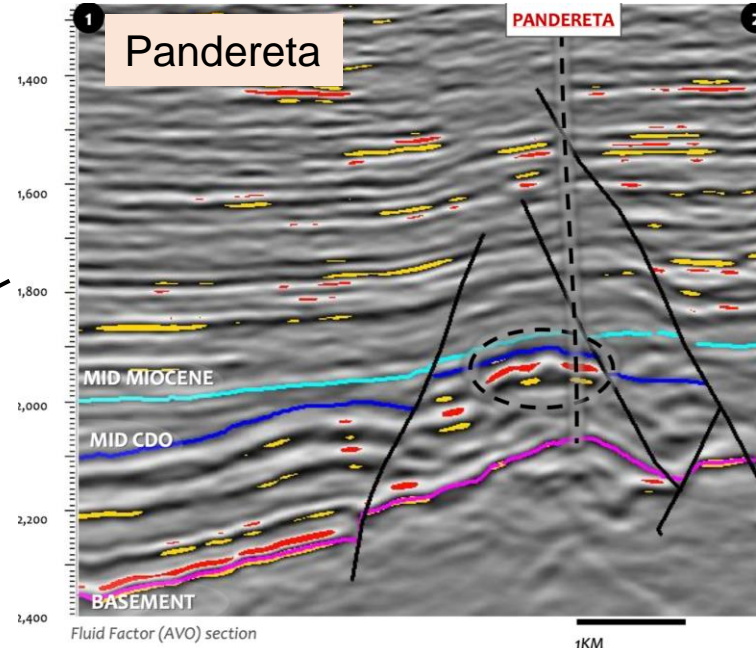
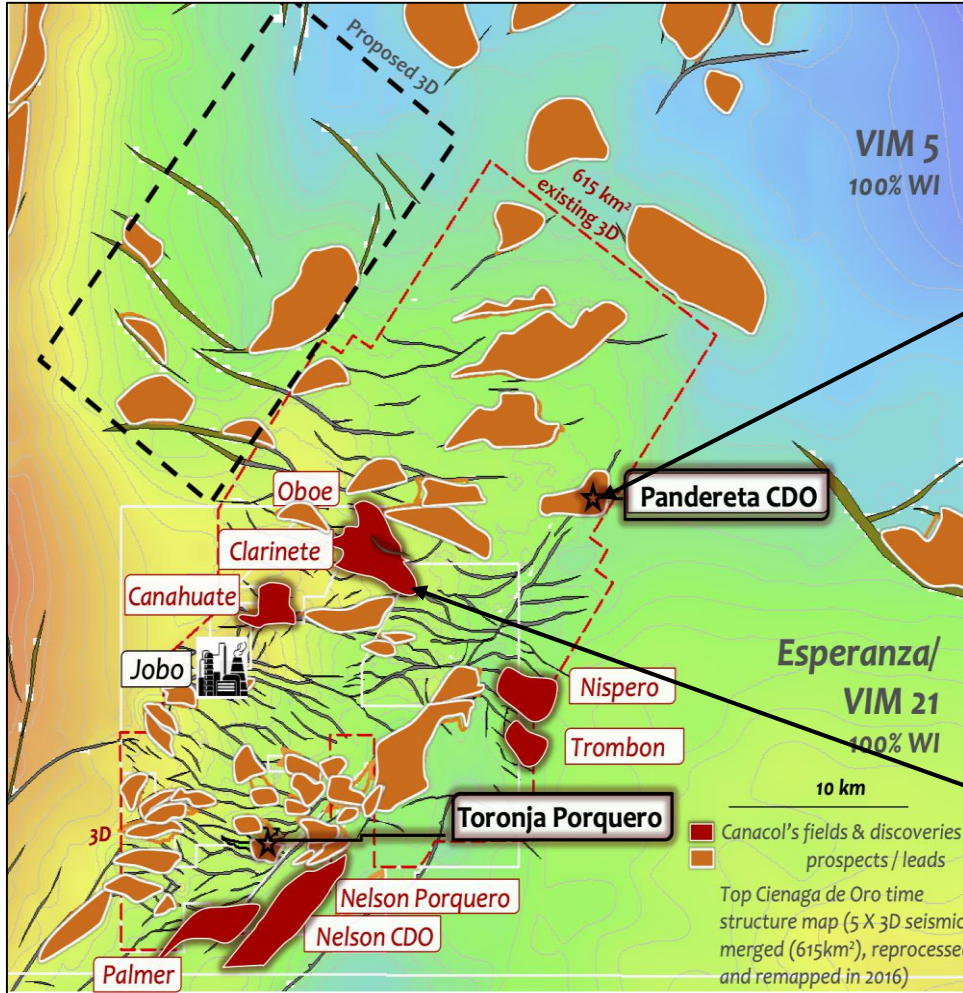




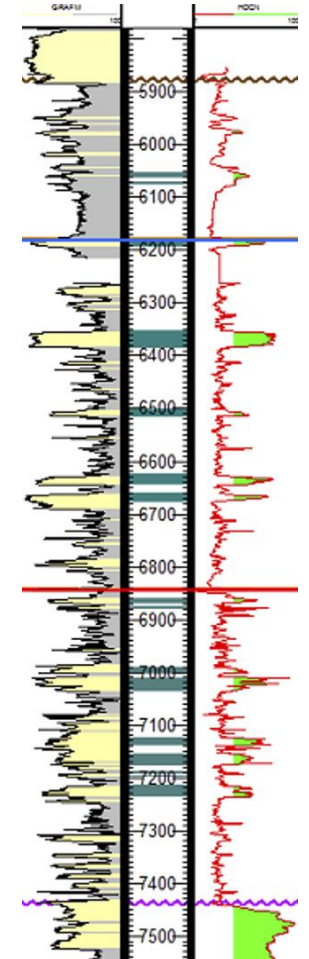


Major discoveries Last 10 years

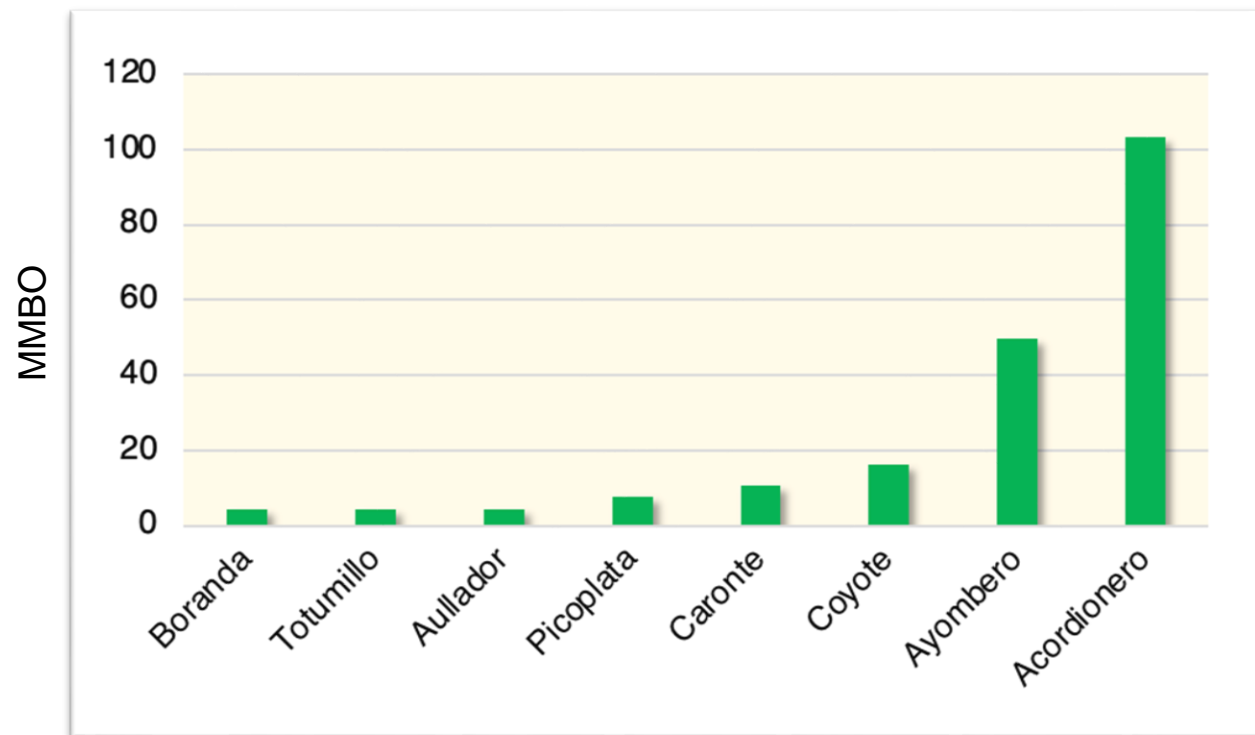
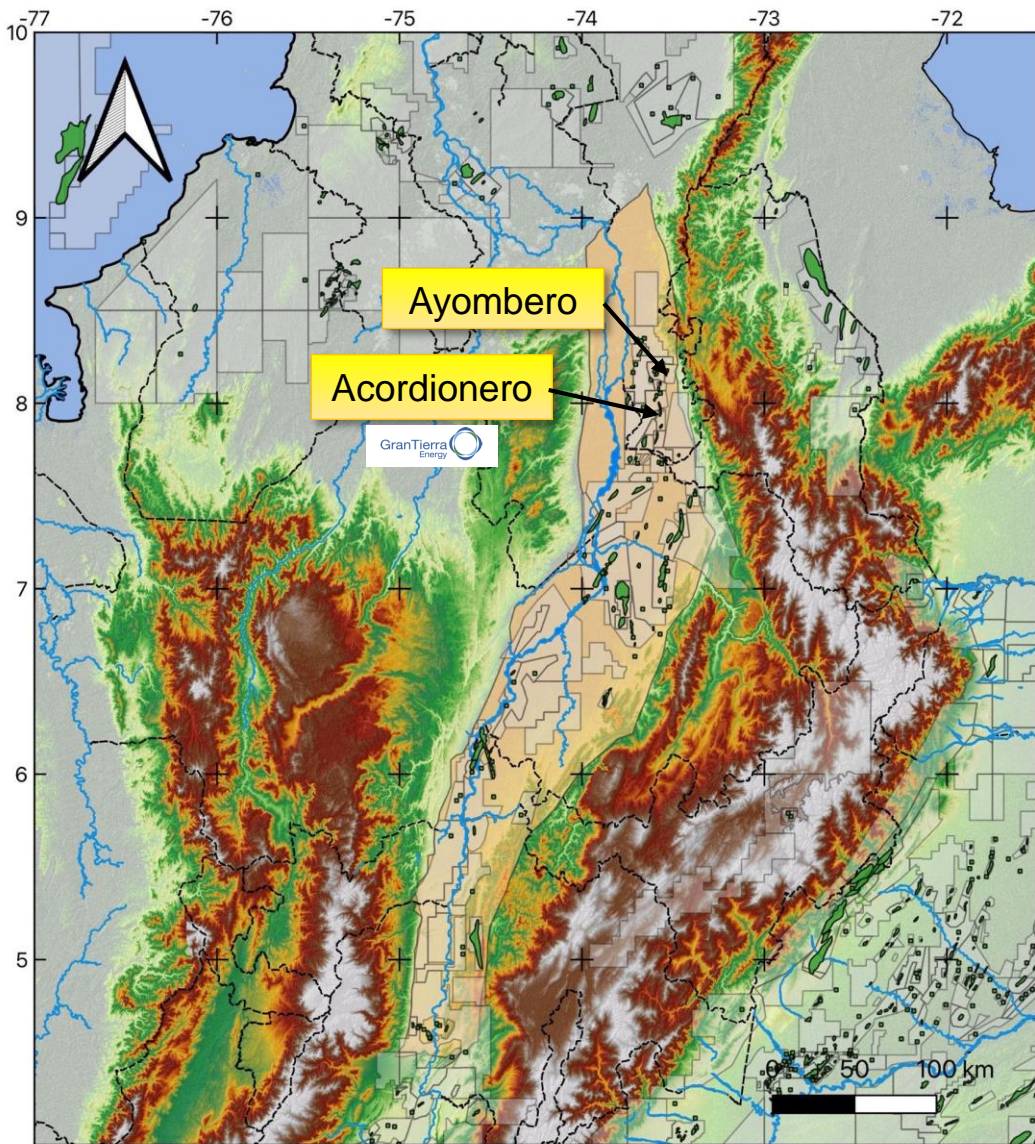


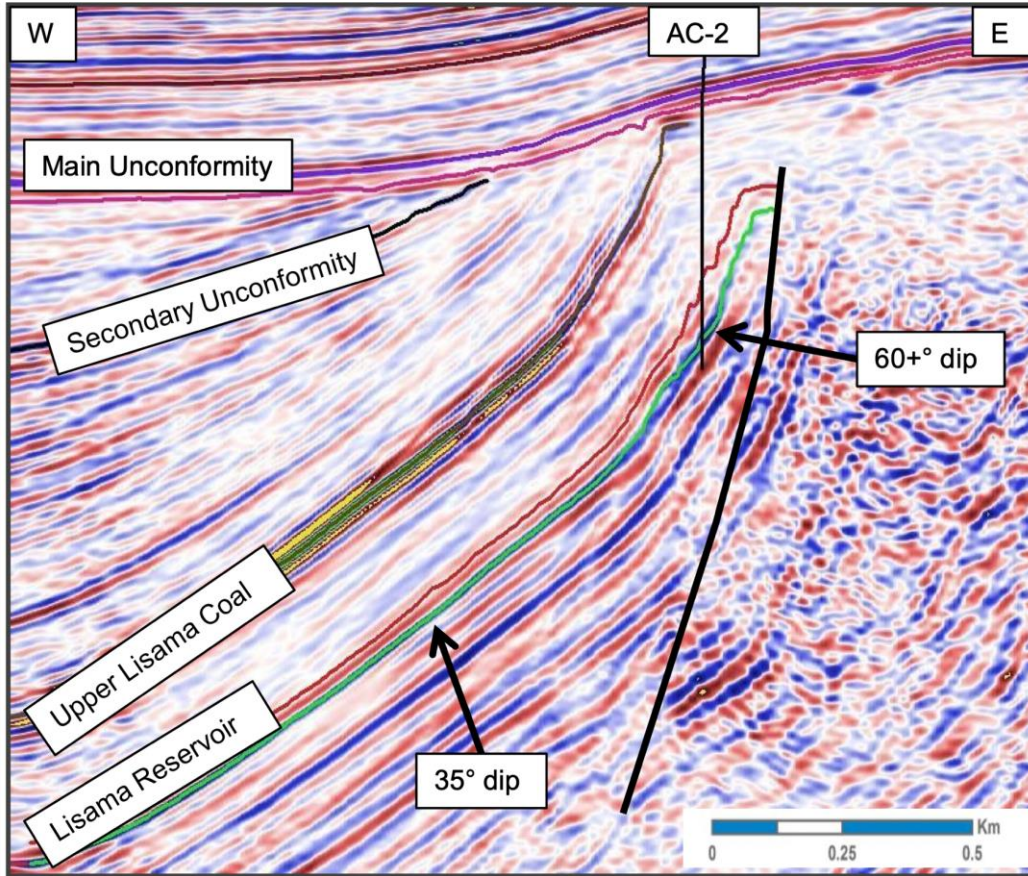


Cienaga de Oro Fm.

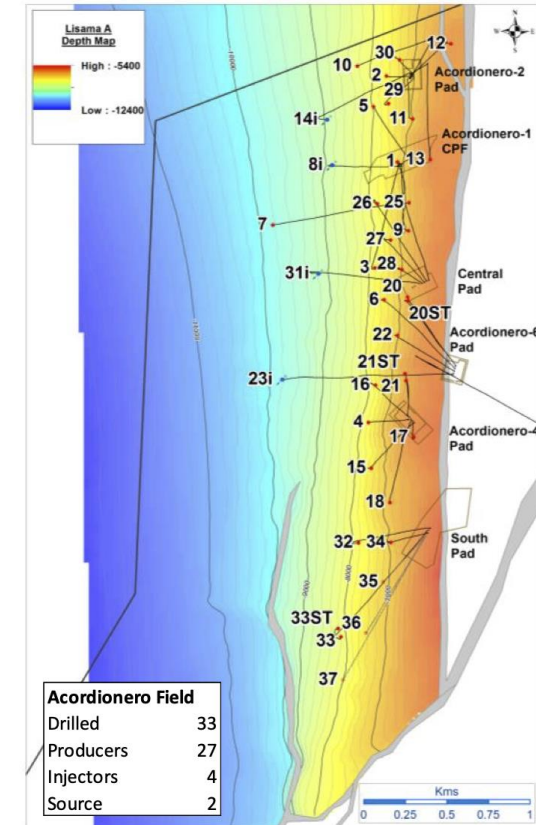
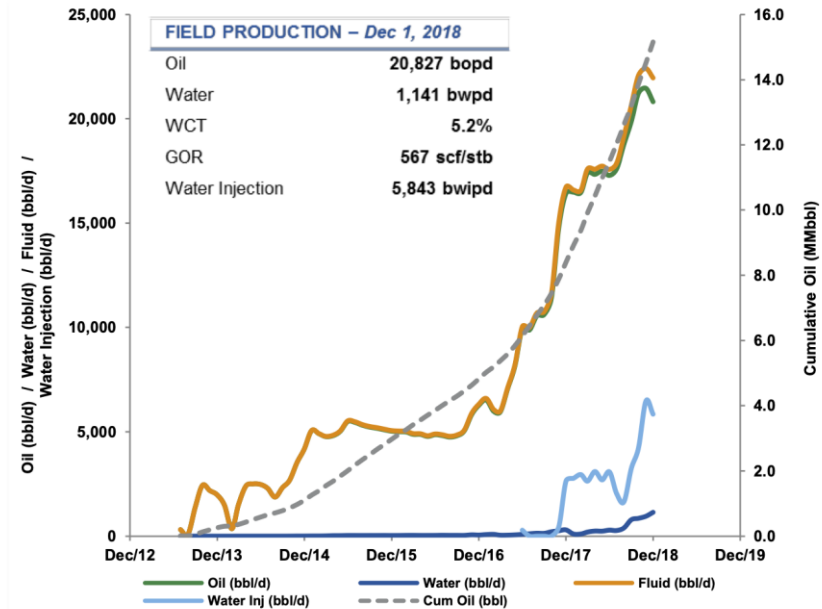


From Canacol, published sources





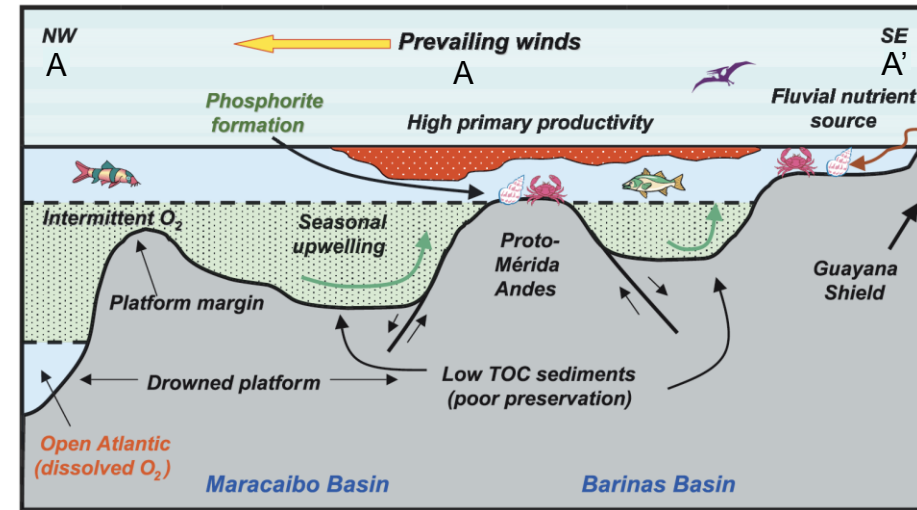
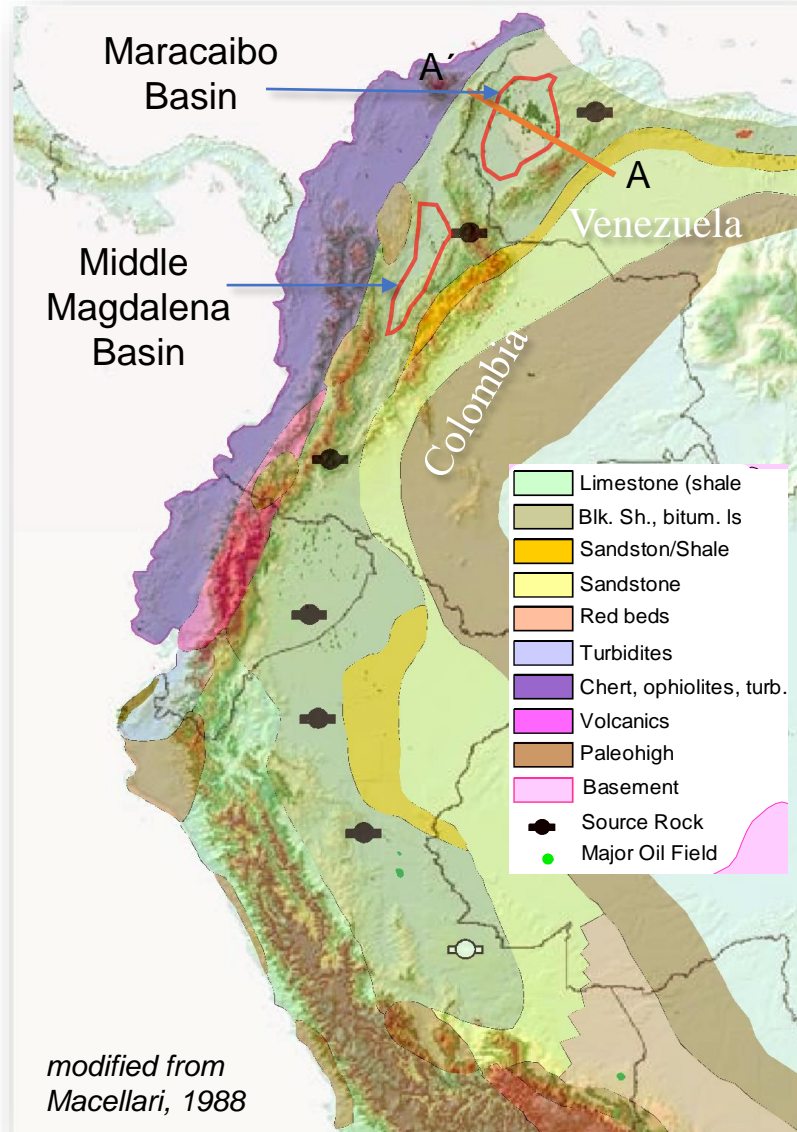
## ACORDIONERO – FIELD OVERVIEW



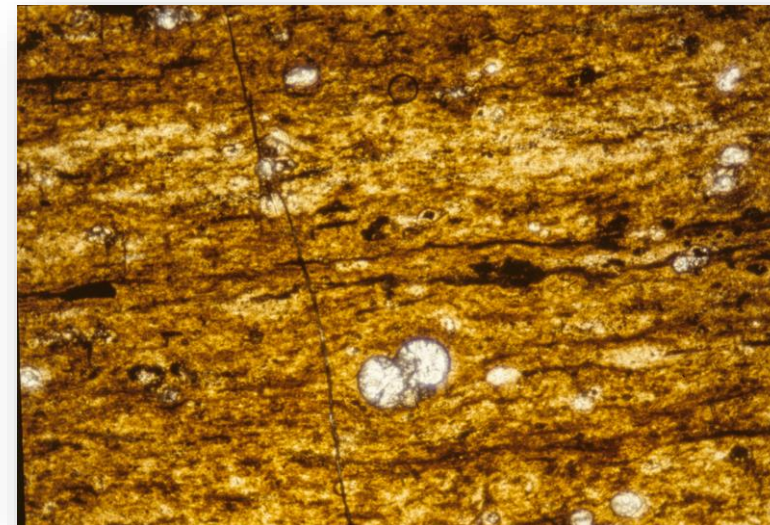
# Paleogeography La Luna Sea – Upper Cretaceous

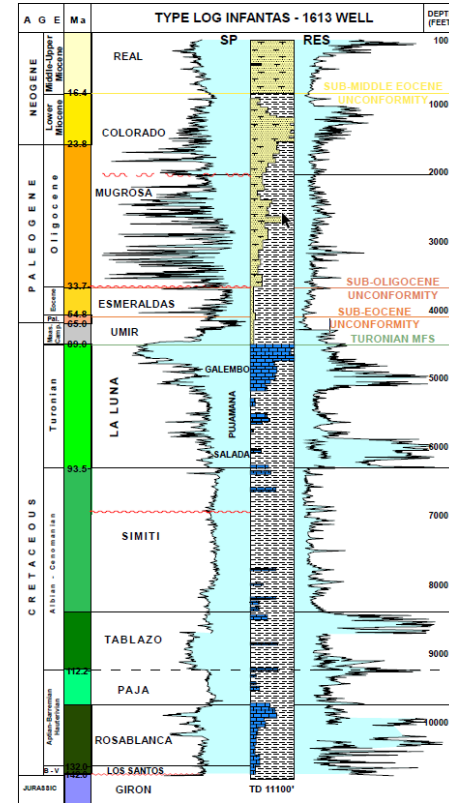
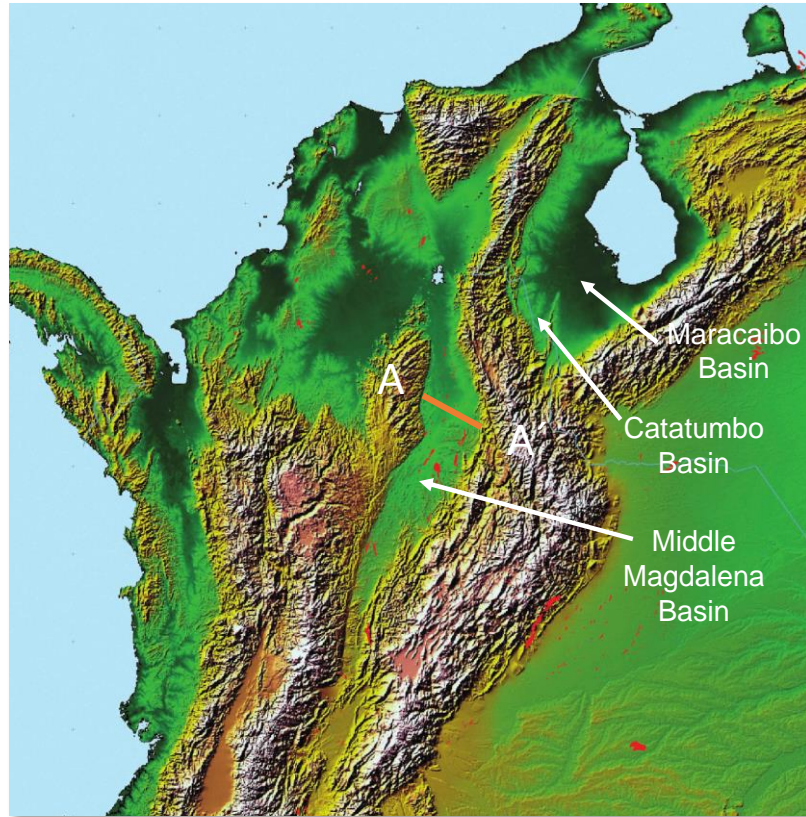


## Turonian – Santonian Paleogeography

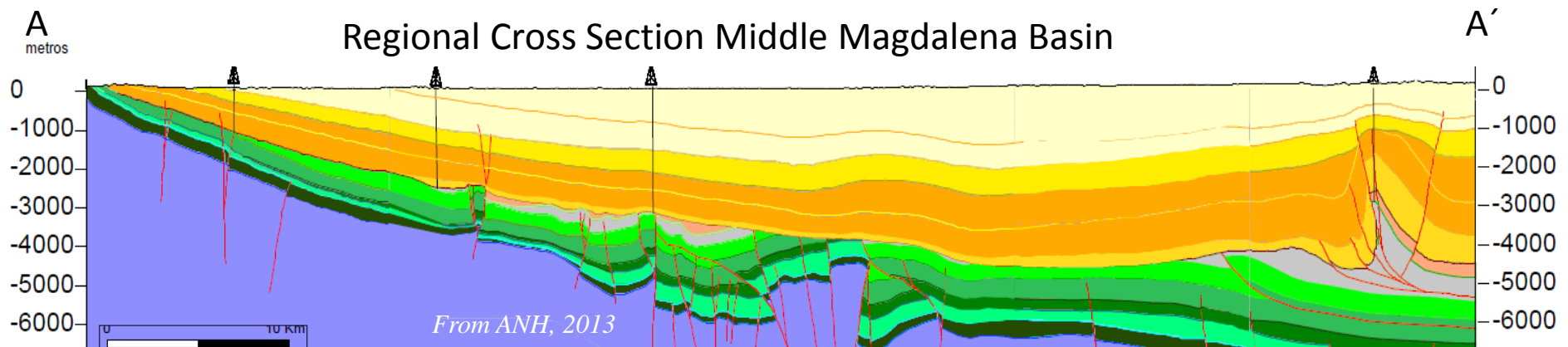


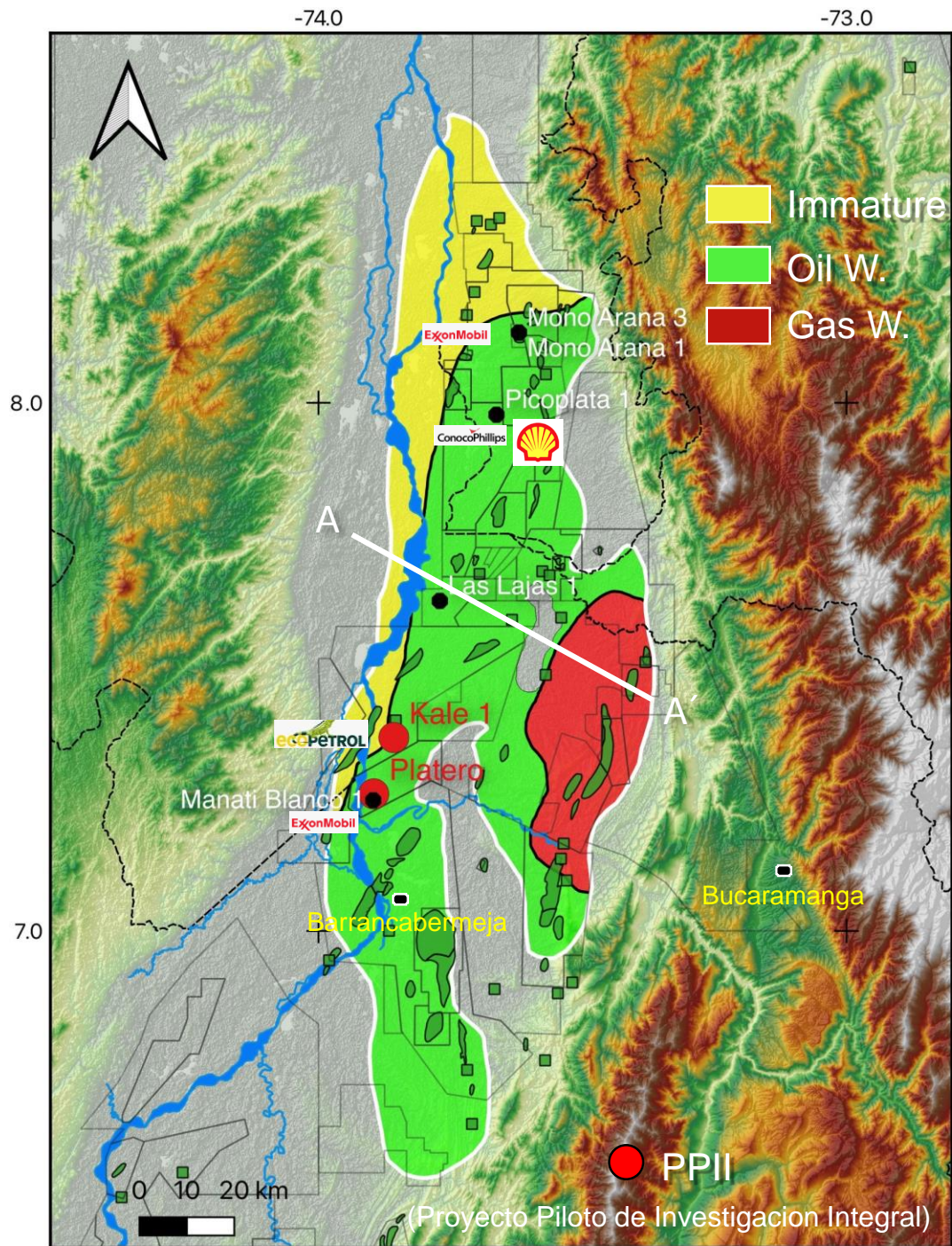
**La Luna TOC: 0,3 – 12,25%**





**La Luna**  
**TOC: 0,3 – 12,25%**  
**Ro: 0,3 – 4,92%**





# Maturity and Resources La Luna MMV - Unconventional

Area Oil: 5070 Km<sup>2</sup>  
 Area Gas: 1080 Km<sup>2</sup>

## Resources

EIA, 2015:

Oil = 4.76 Bbls

Gas = 18.30 Tcf

Mora et al, 2018:

Oil = 8.29 Bbls

Gas = 24.83 Tcf

Veiga, et al., 2022:

Oil = 2.9 Bbls

in two horizons (Galemba A and D)

## Plan Piloto de Investigacion Integral

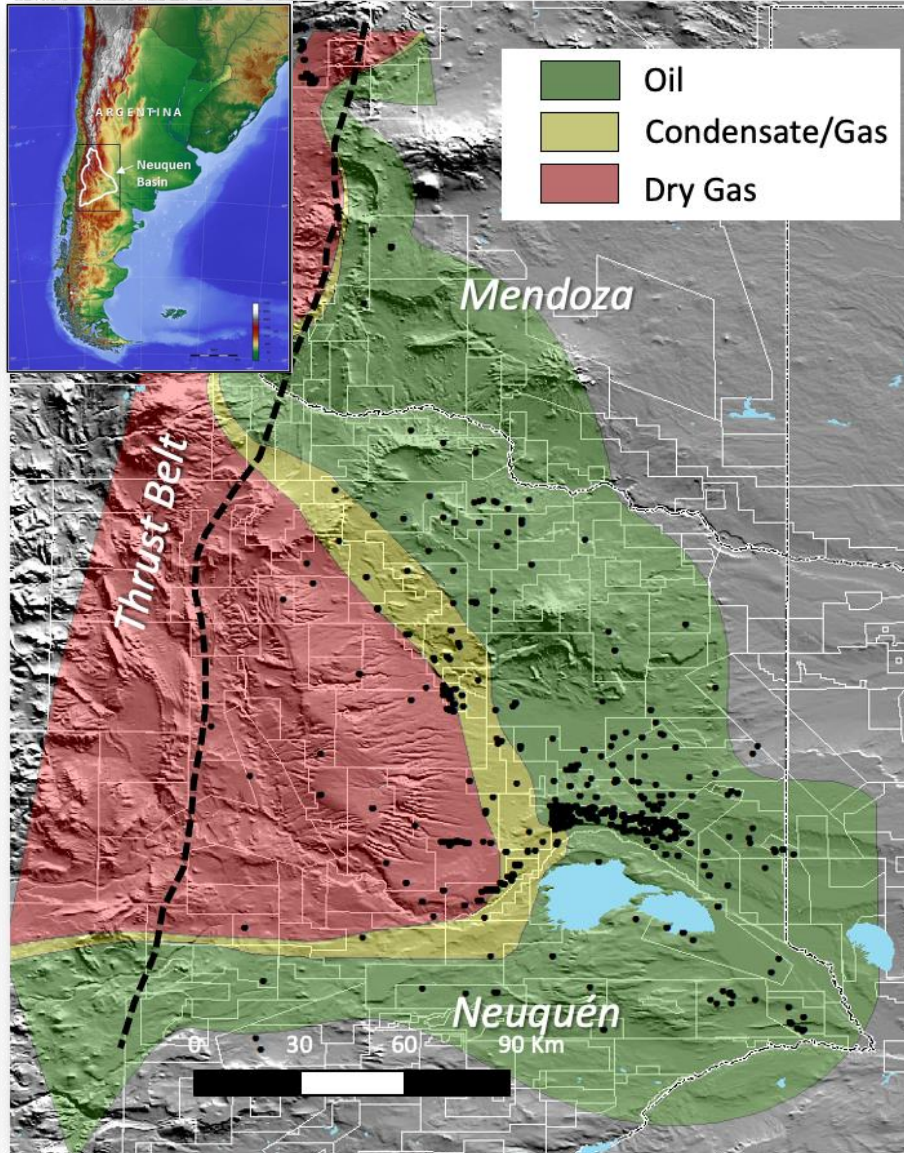
PPII = 8.7 years of oil + 10.4 years of gas reserves

With these projects Colombia could extend 25 years of energy self sufficiency

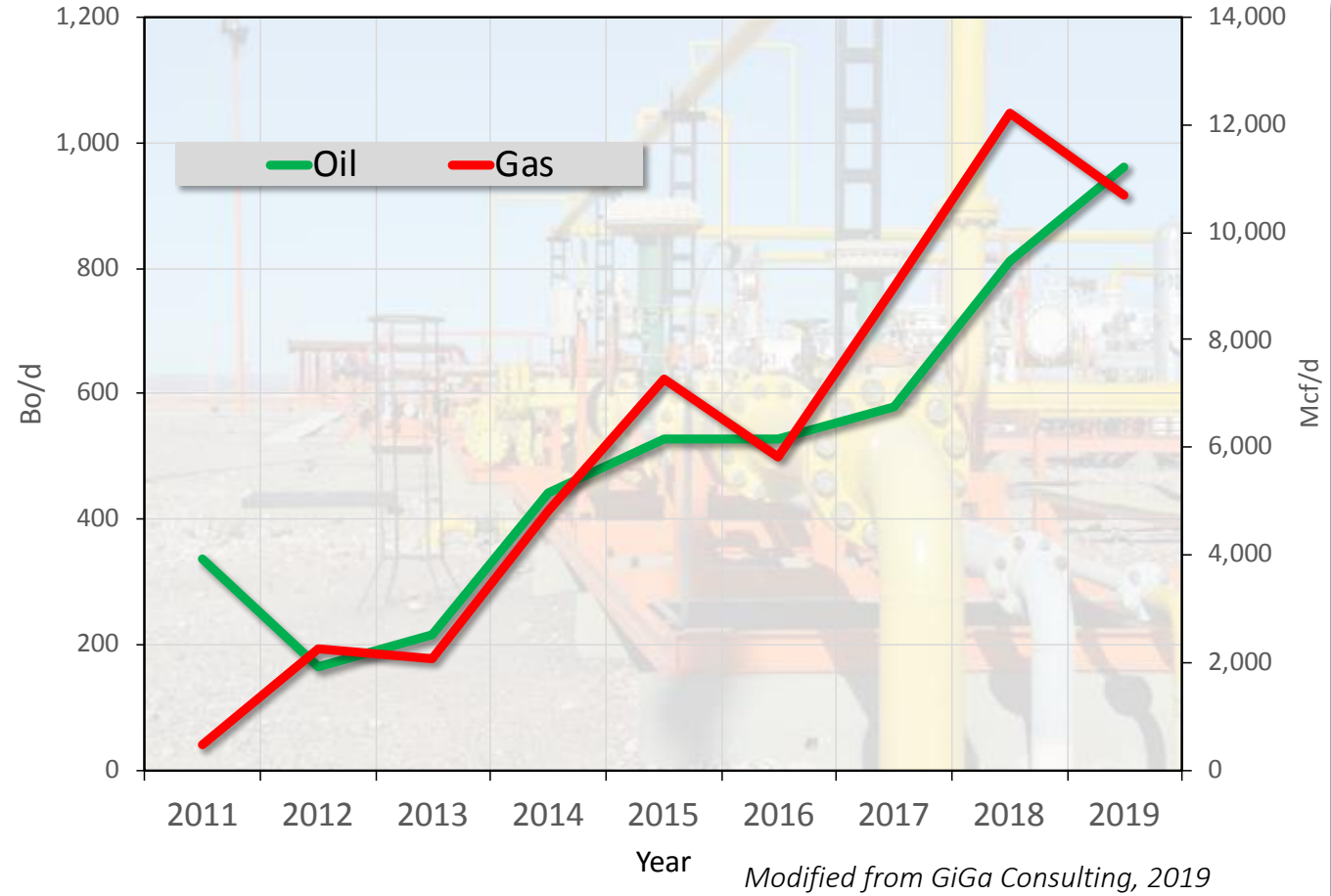


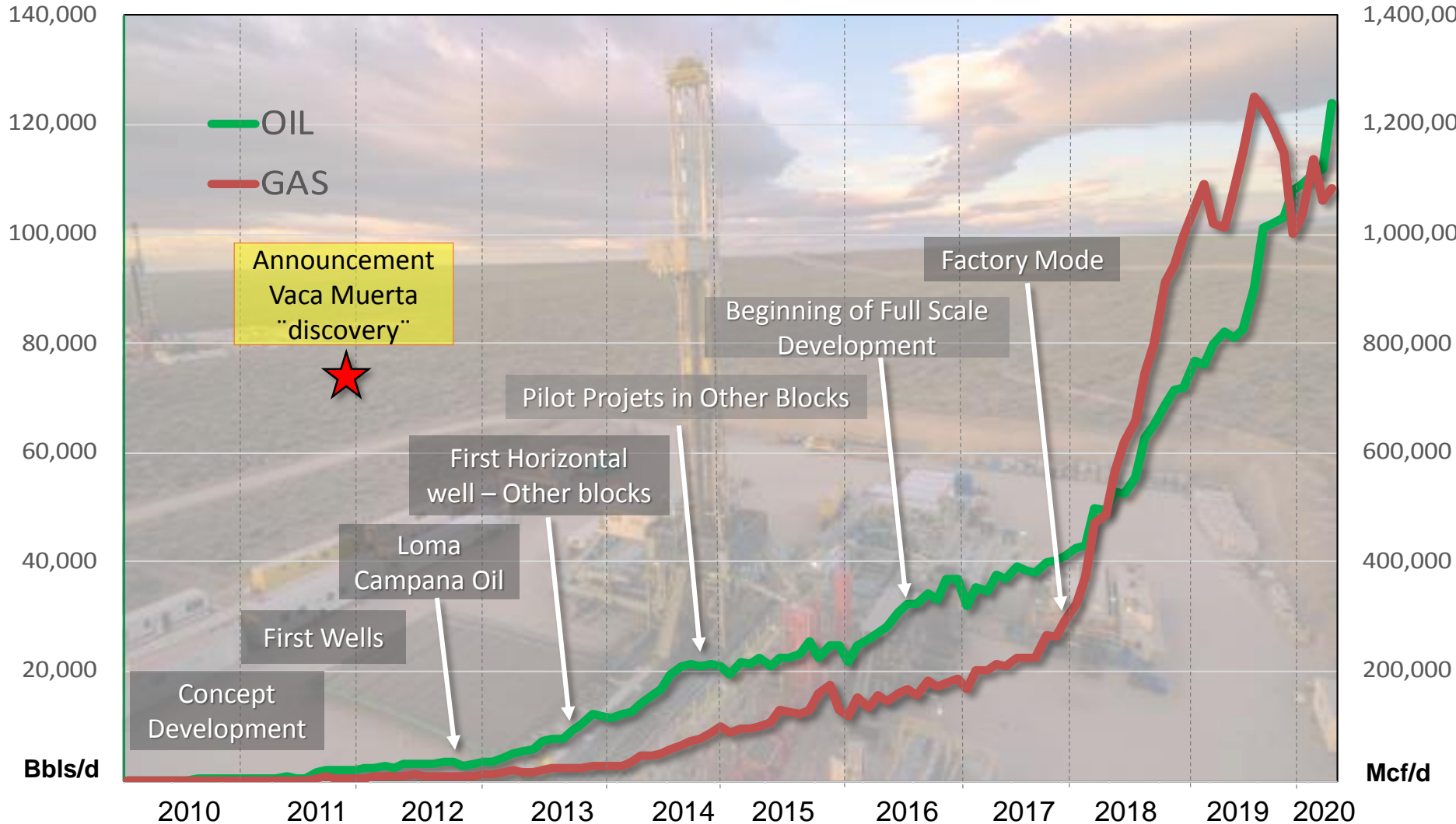


## Maturity Windows – Vaca Muerta Fm.



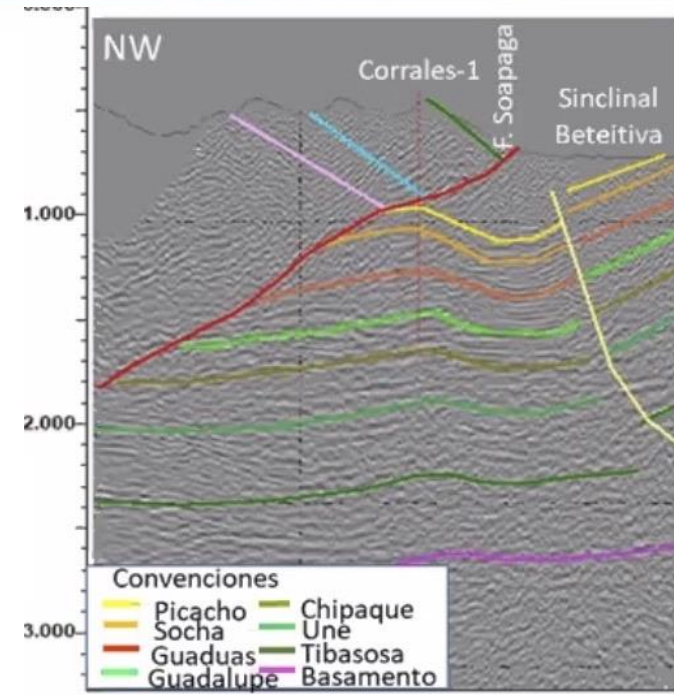
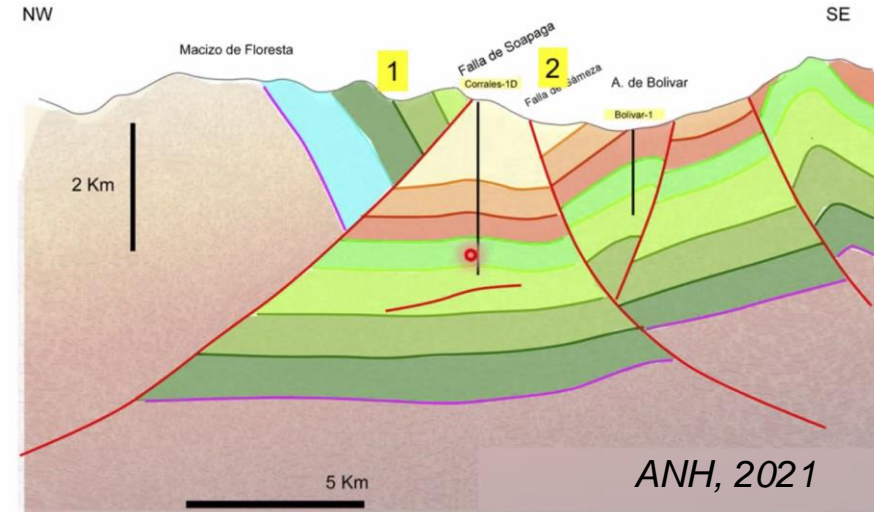
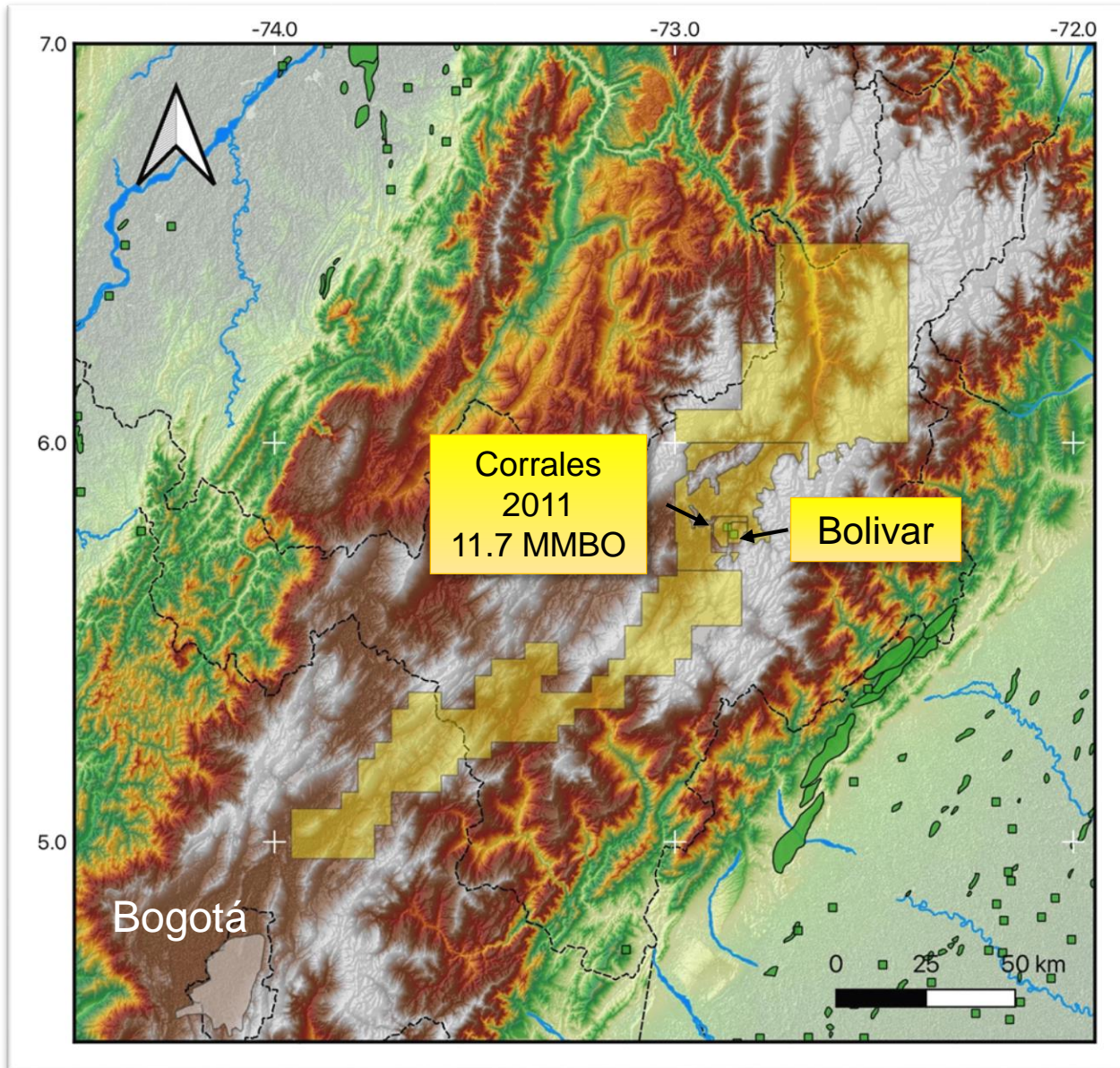
## Average Initial Production Rate Vaca Muerta Wells

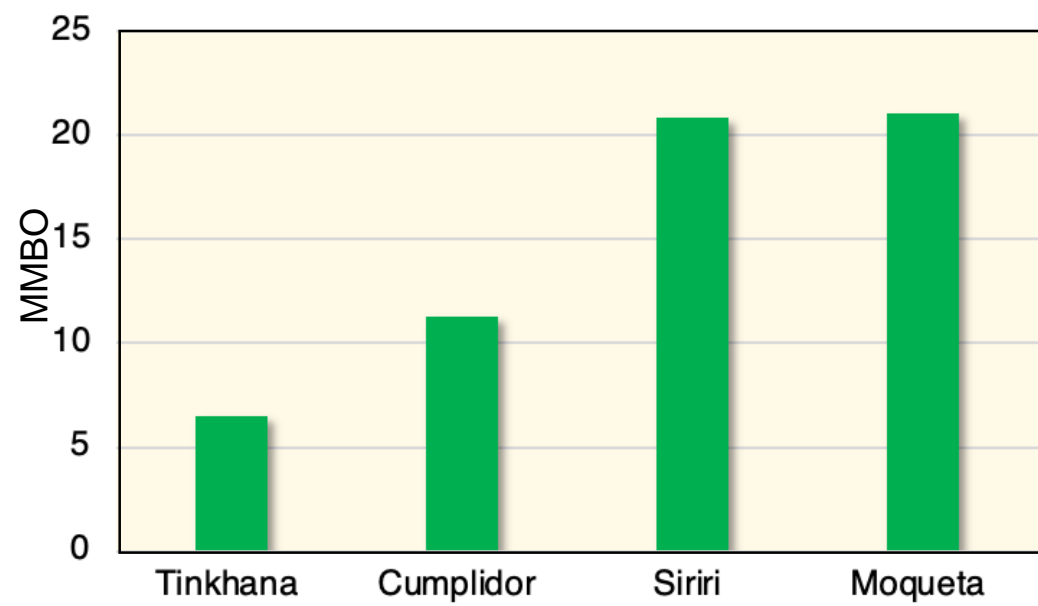
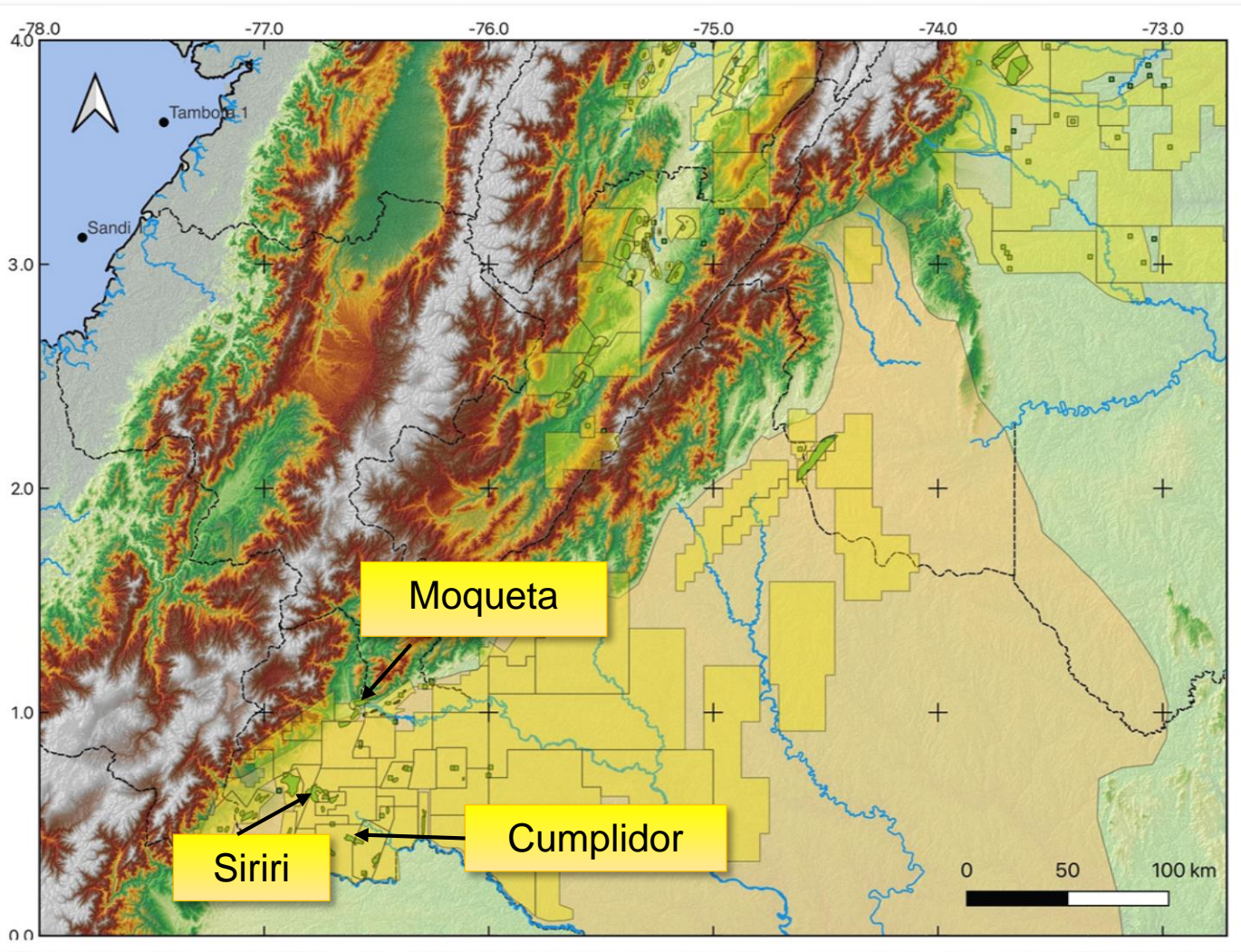




*Present day production =  
221,000 bopd  
1.8 Bcf/d.  
(Colombia gas prod= 1 Bcf/d)*

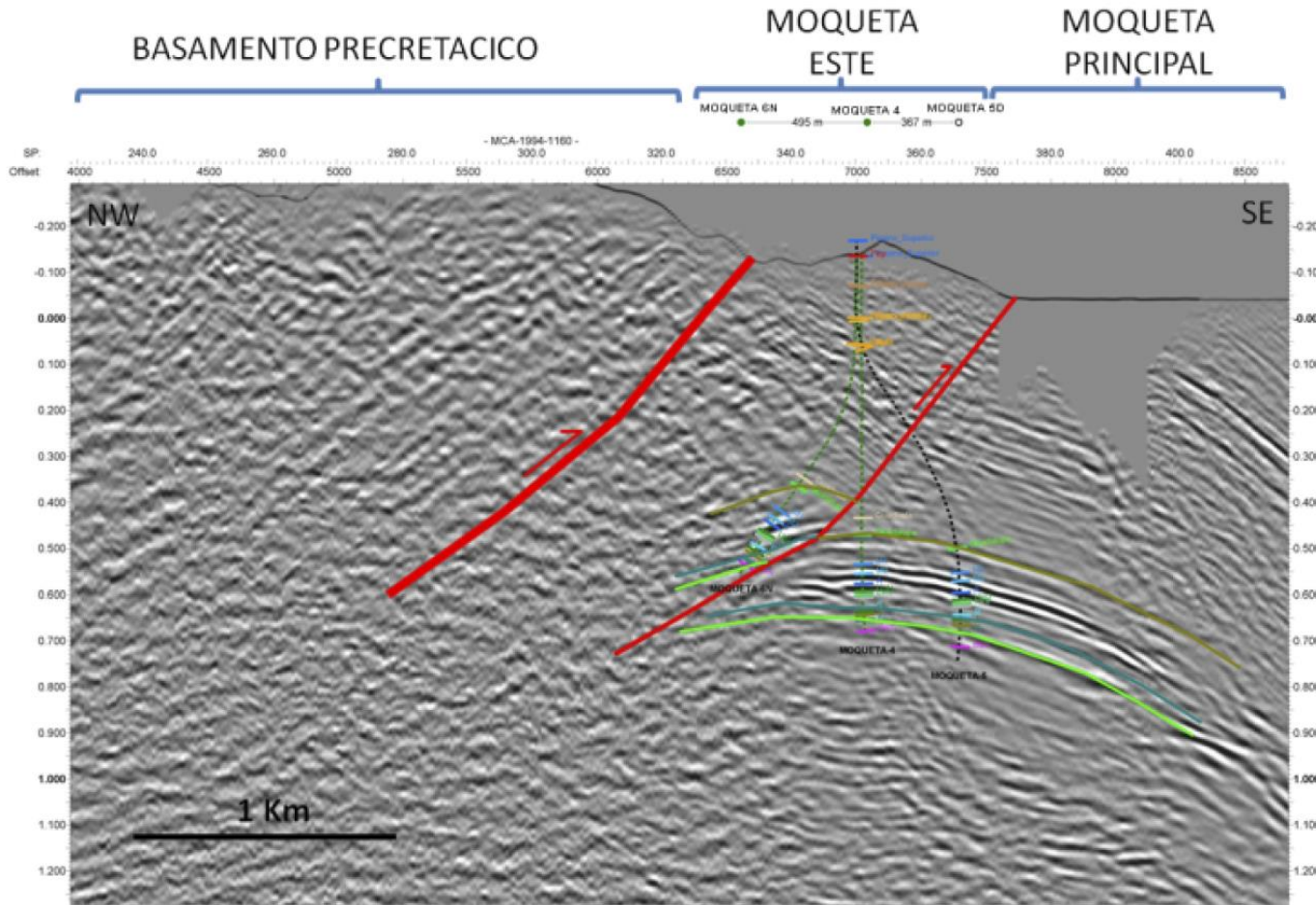
**Within the next 5 years  
Vaca Muerta could lead  
the country to be a net  
exporter of oil and gas**  
*Tecpetrol, 2022*





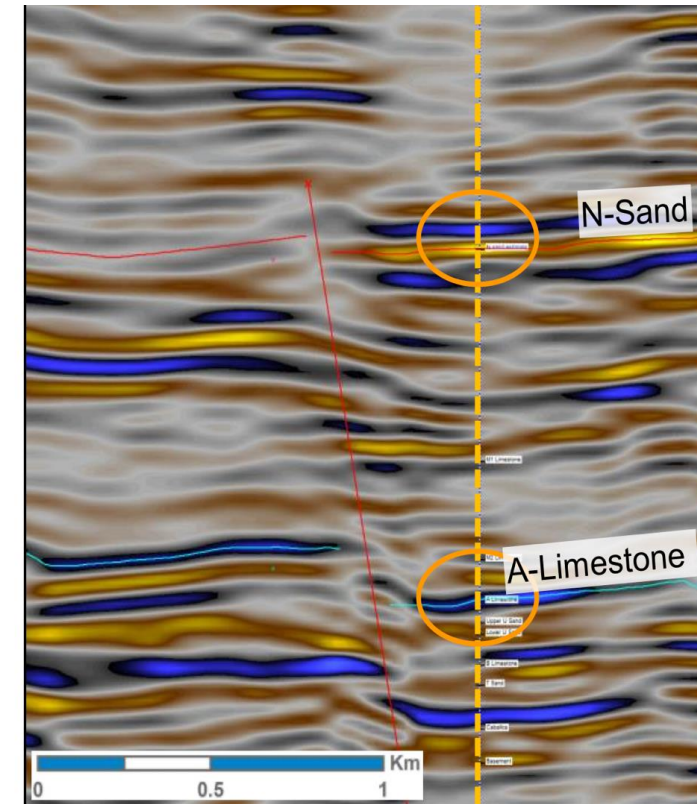


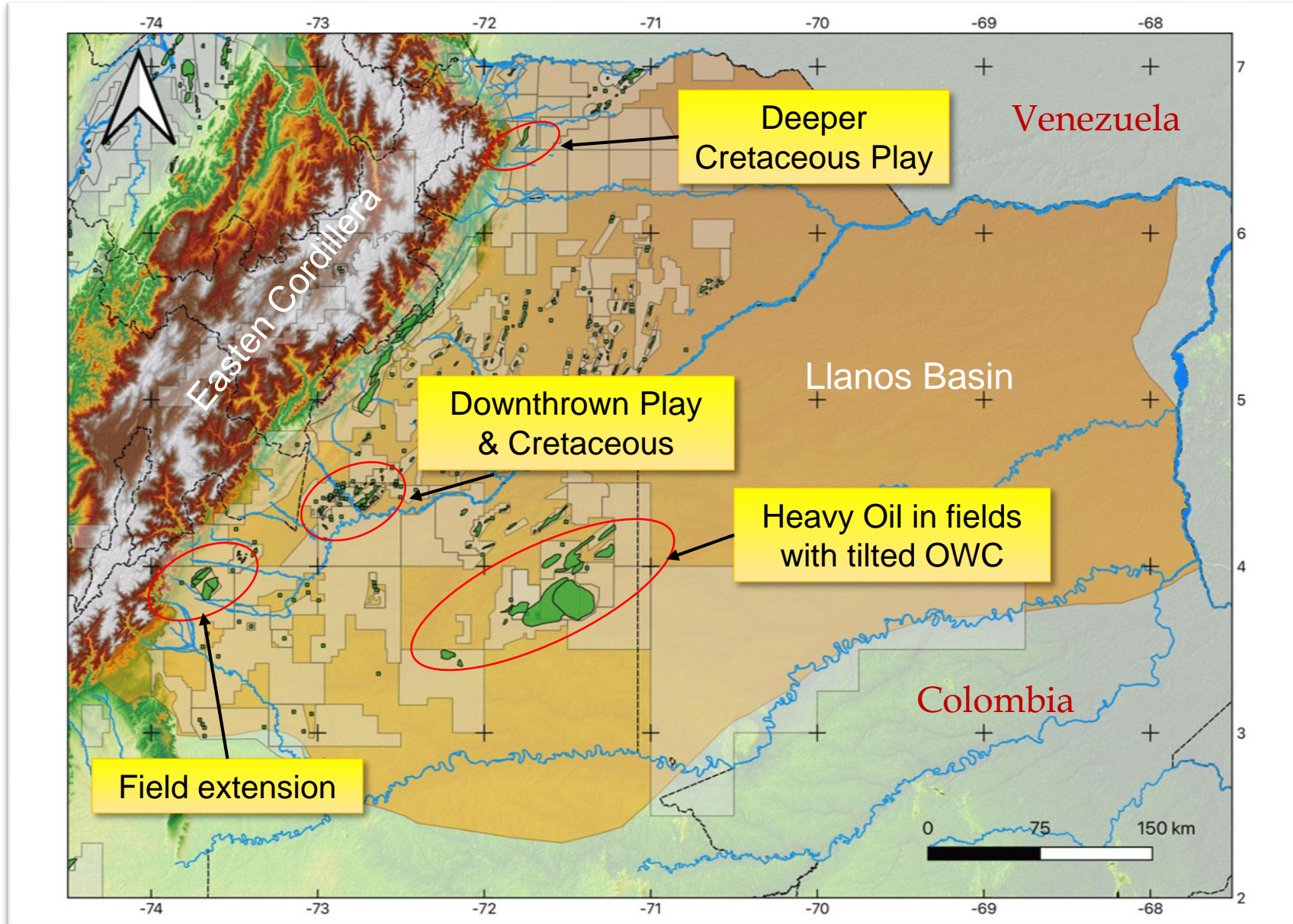
## Moqueta Field



Ramirez et al., 2012

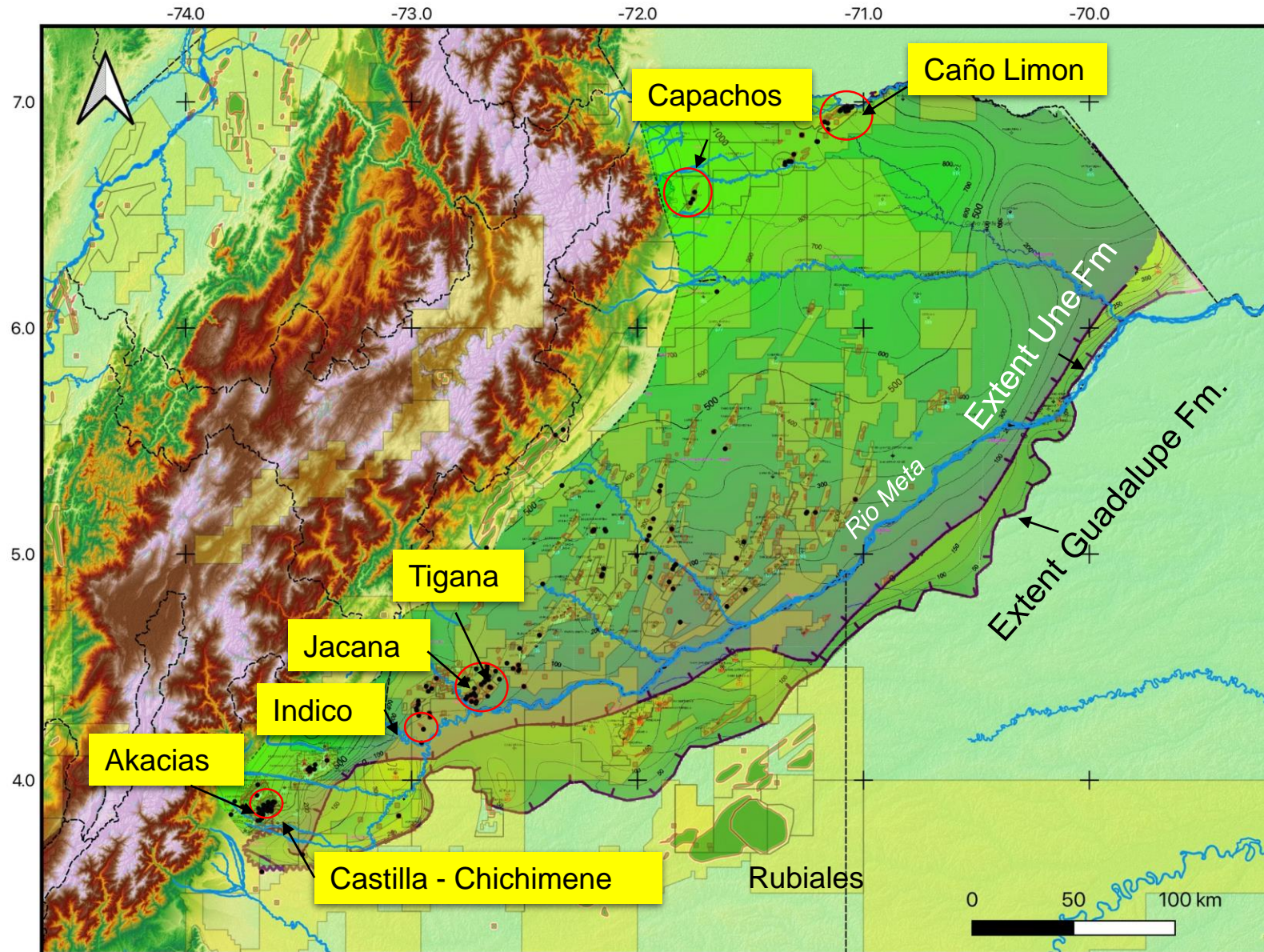
## Siriri Field





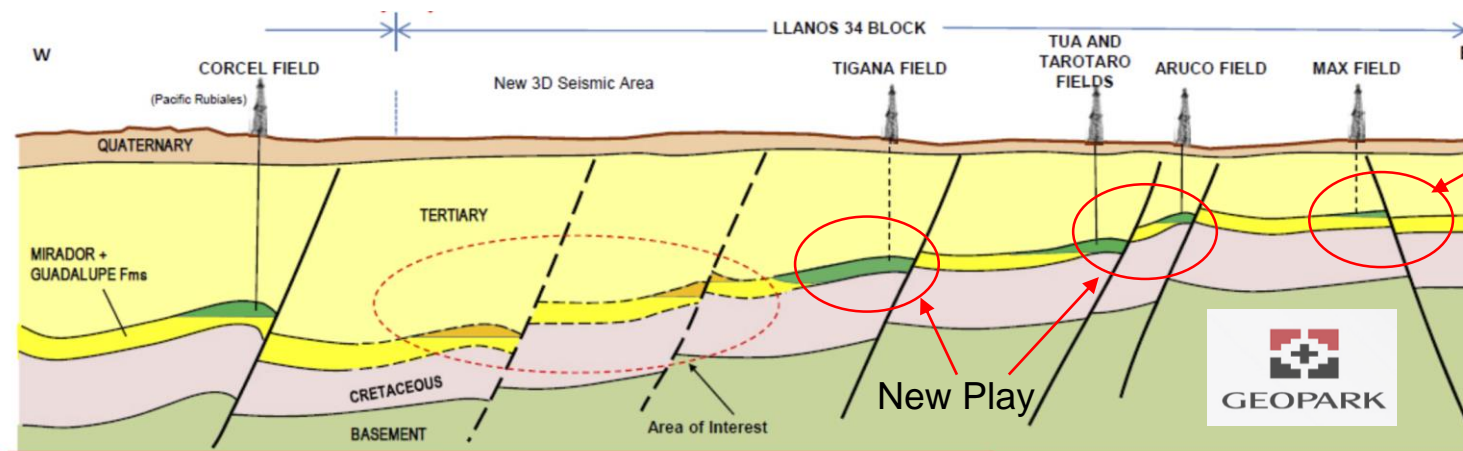
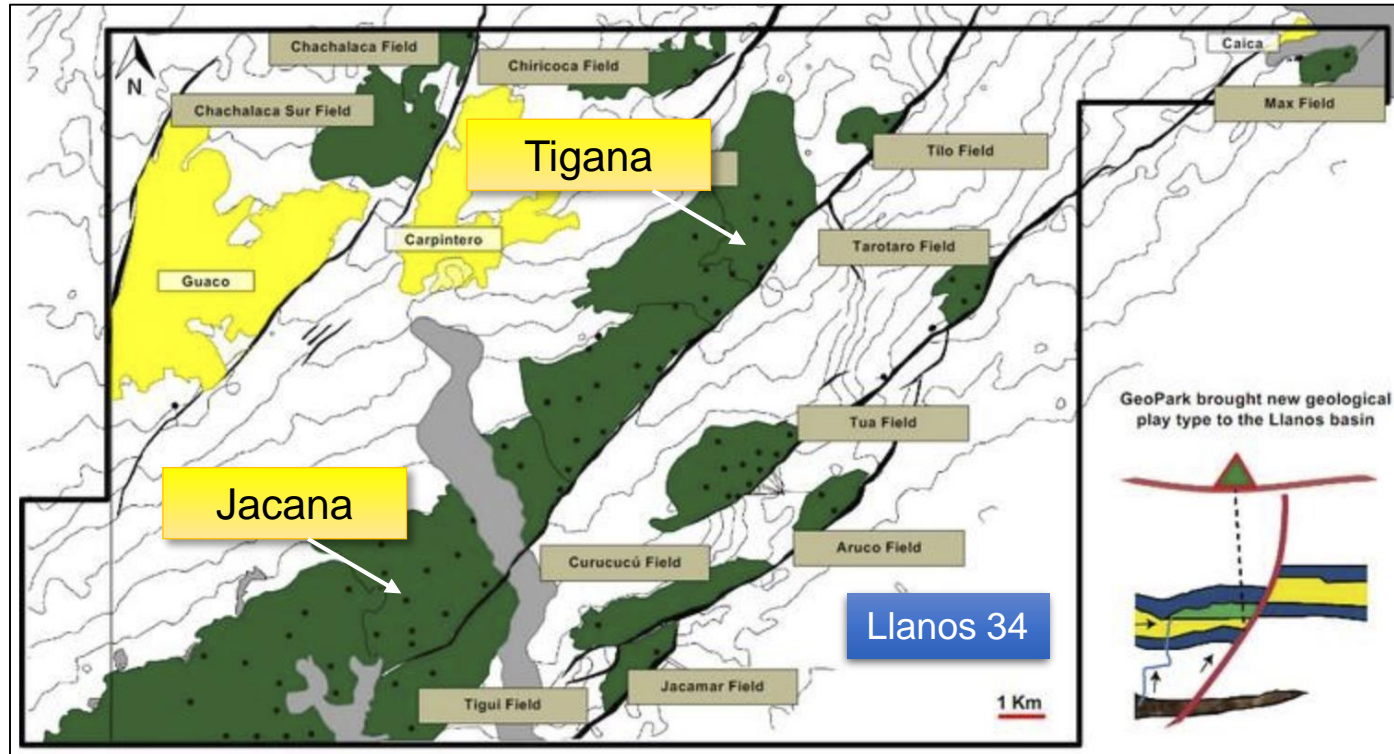
**1.6 Bbo**  
**550 Bcf**

# Llanos Basin – Cretaceous Play



*modified from  
Landmark Halliburton, 2006*

# Downthrown Play



Traditional Llanos Play

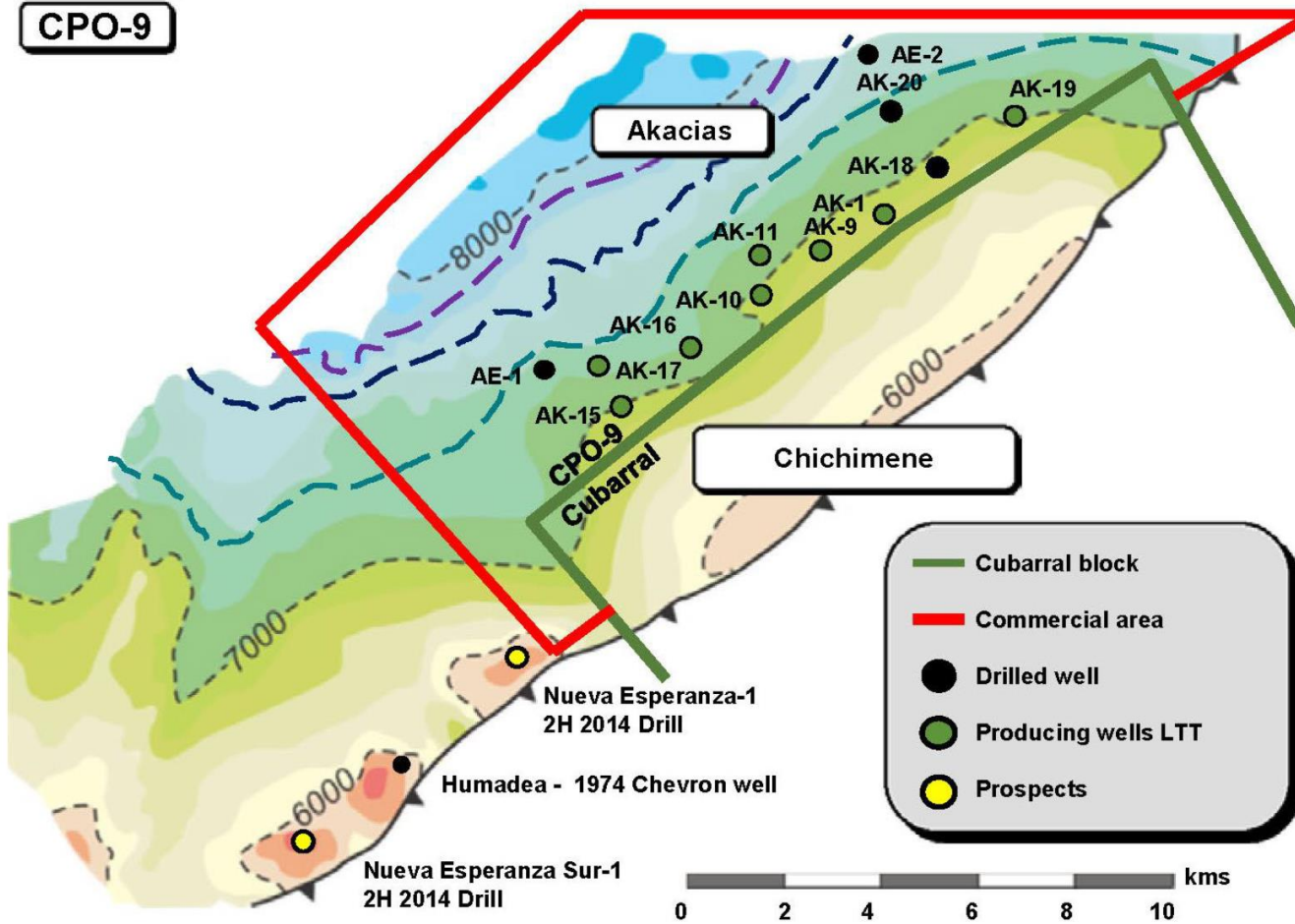
New Play







## Akacias Field

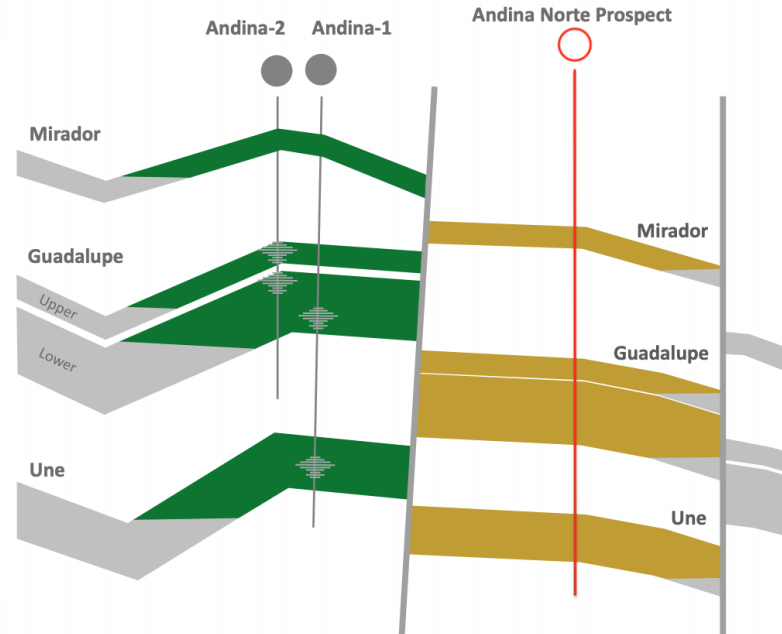
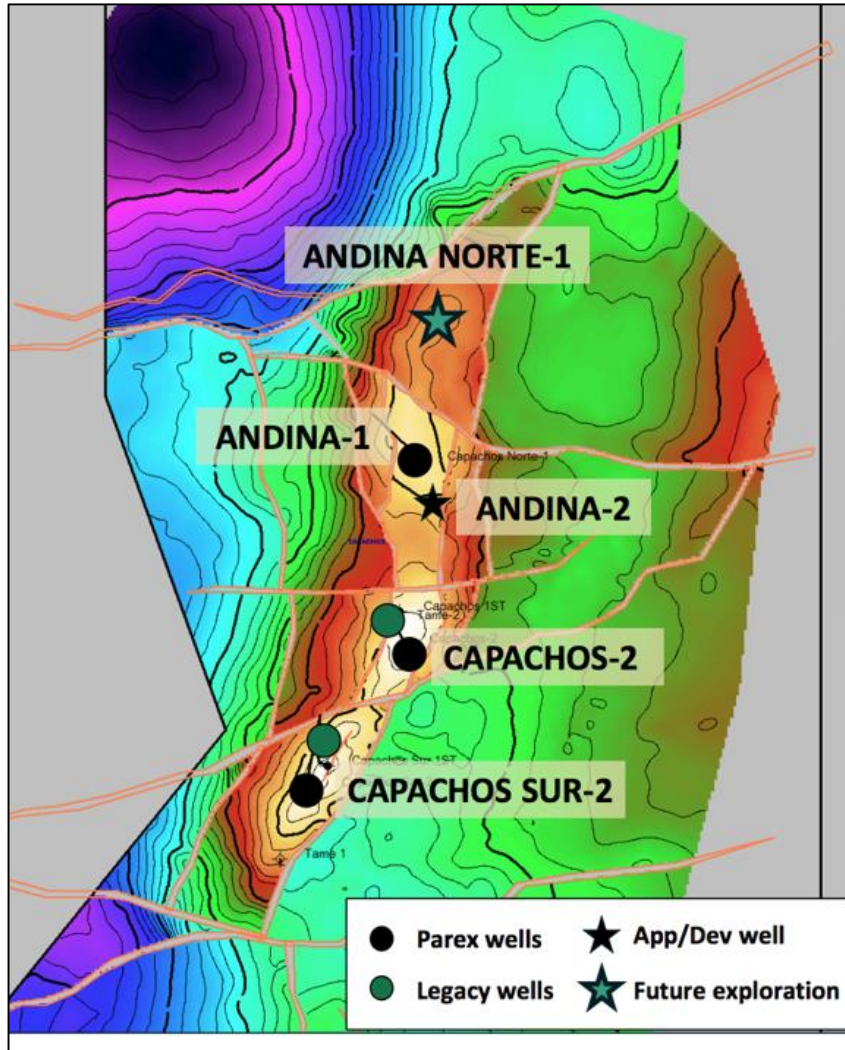


Downdip extension of Chichimene structure. Production of 9.3 degrees API oil from T2, K1 and K2 formations.

- OOIP 2.5 Bbo

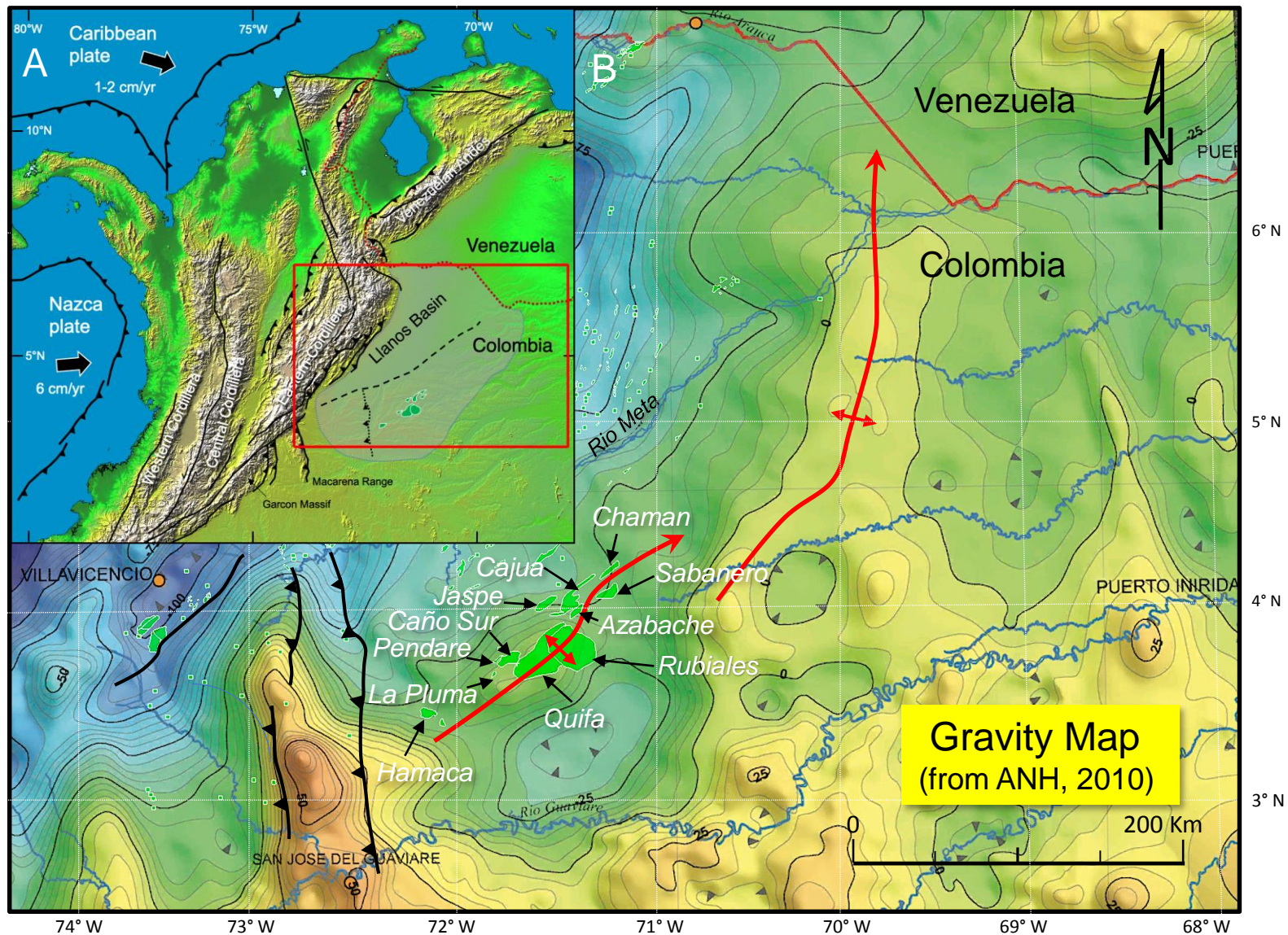
Scotiabank, 2016

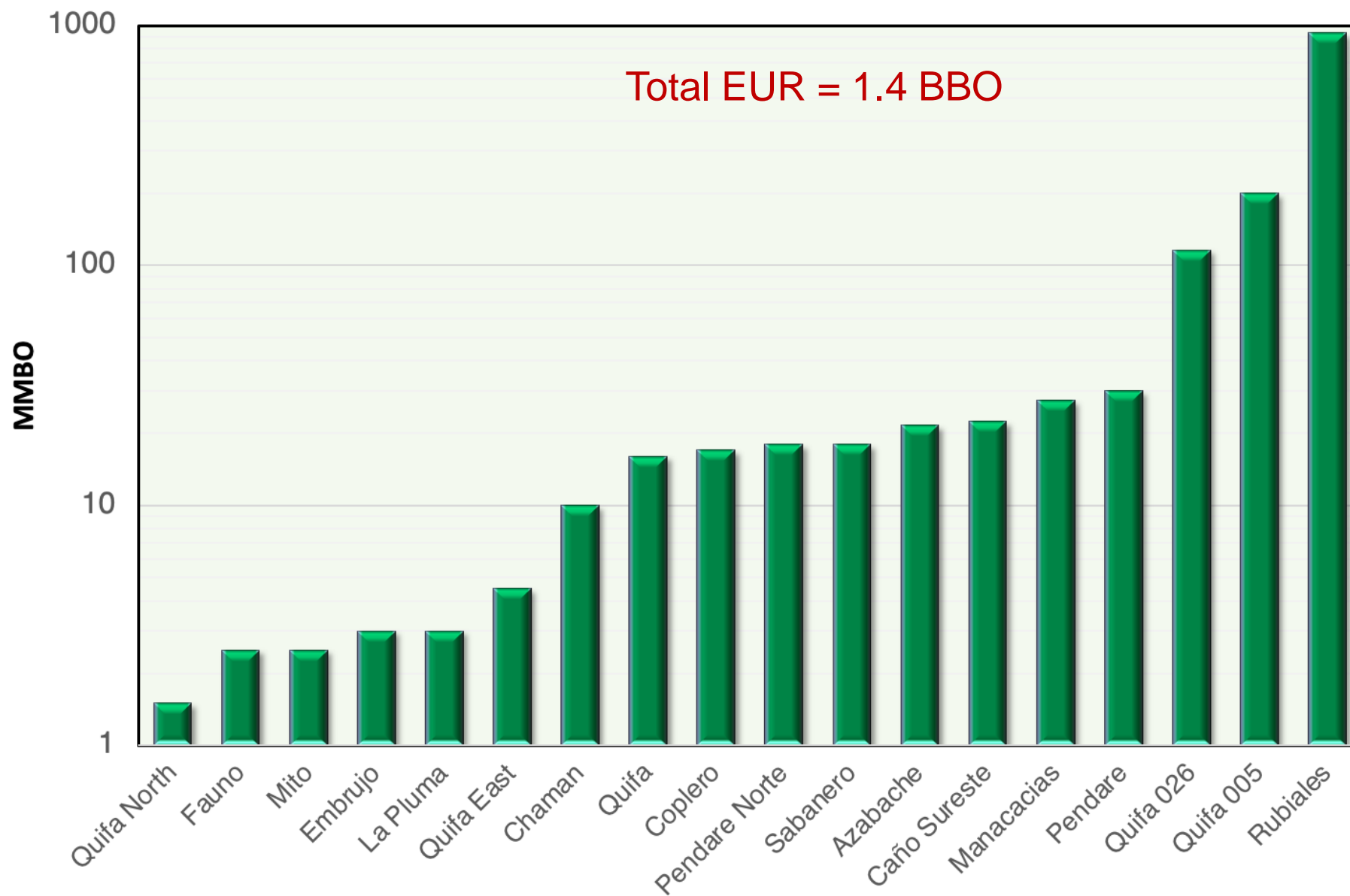


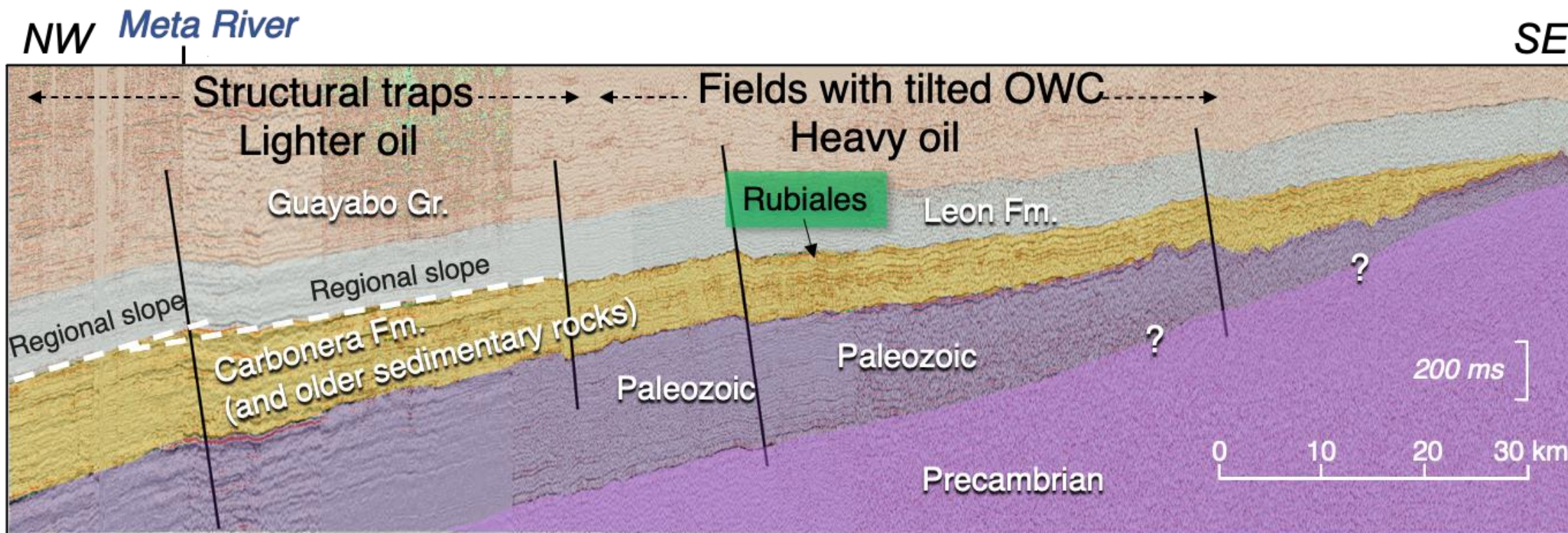


Prospective Zones	Andina-1	Andina-2
<b>Mirador</b>	Untested	Untested
<b>Guadalupe</b>	Producing ~1,000 bopd (restricted)	-
Upper Guad.	Untested	1,606 bopd & 0.8 MMcf/d (gross)
Lower Guad.	2,570 bopd & 1.2 MMcf/d (gross)	2,195 bopd & 0.9 MMcf/d (gross)
<b>Une</b>	2,545 bopd & 8.7 MMcf/d (gross)	Untested

# Heavy Oil Play









Structural trap

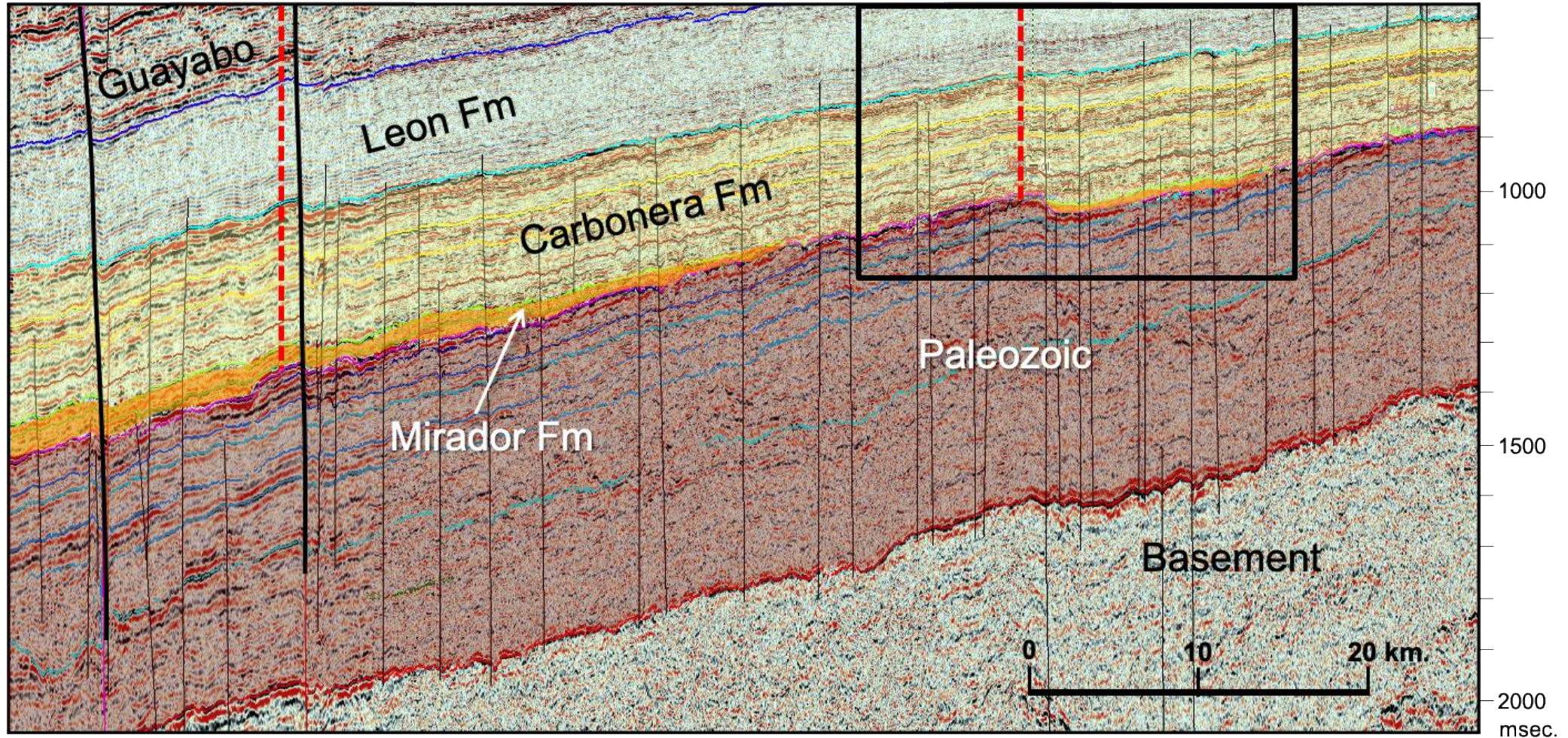
**Cara Cara Sur**

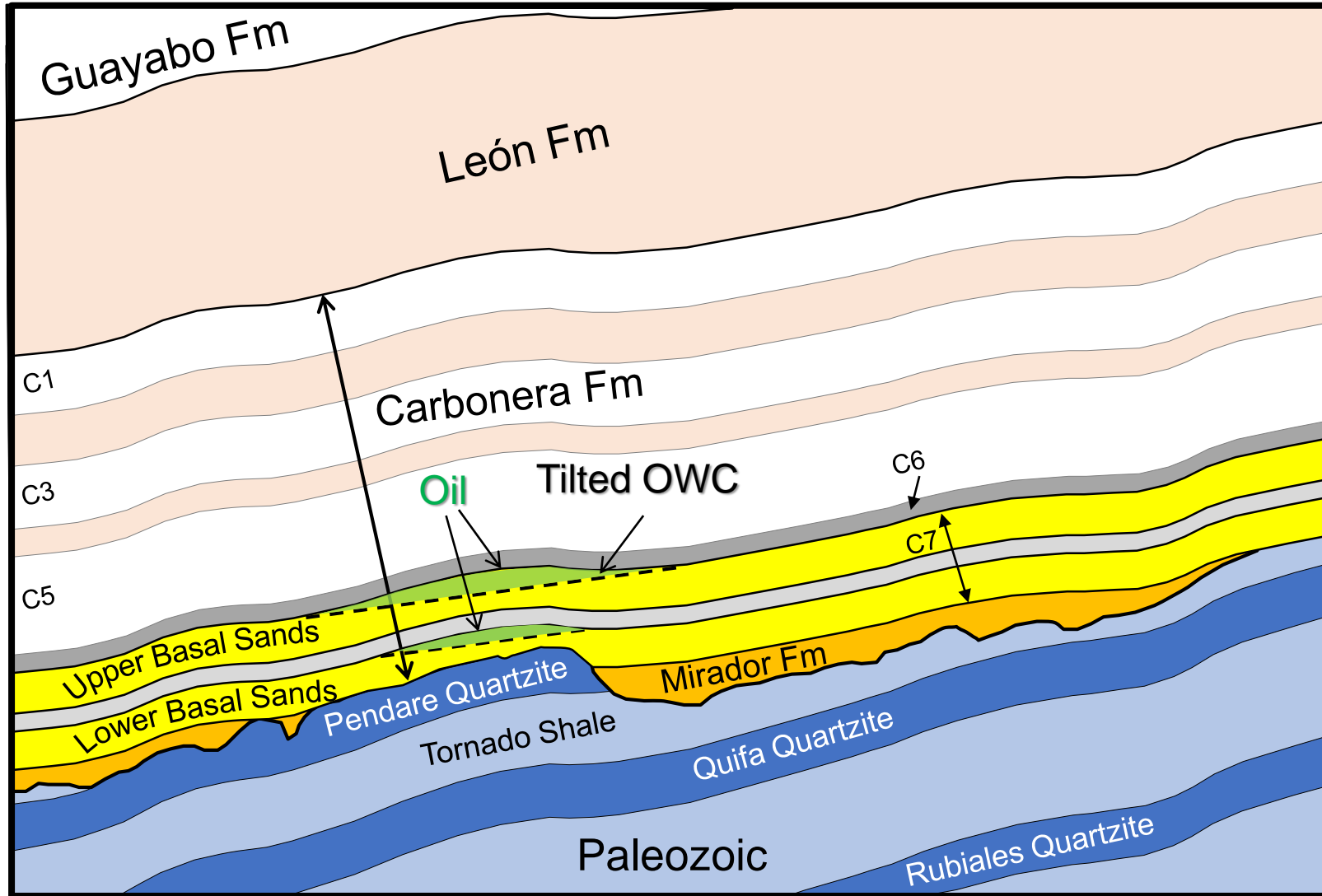
Stratigraphic trap

**Pendare**

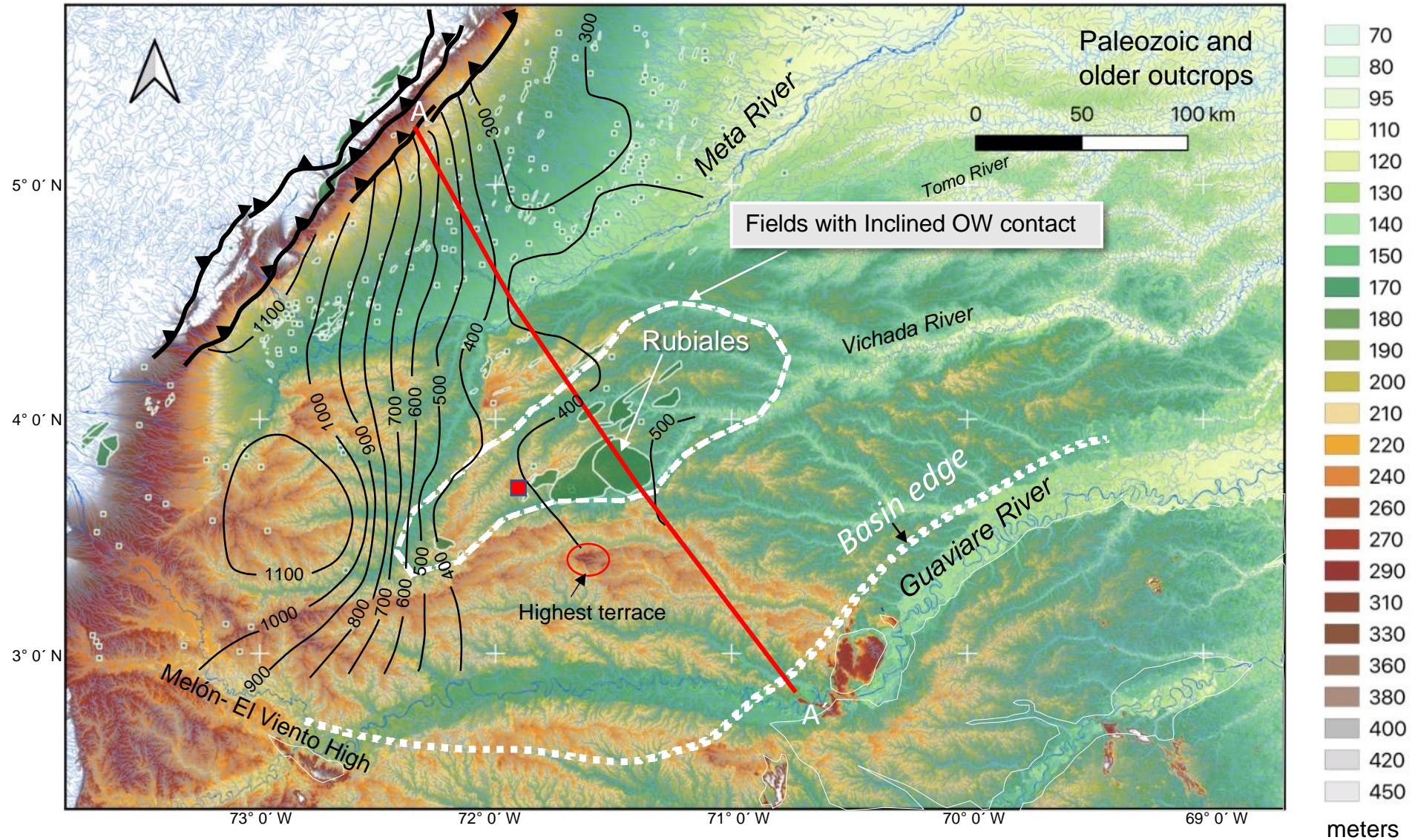
NW

SE





# Topography Southern Llanos Basin



Black lines are hydraulic-head contours (in feet) for the C7 aquifer (from *Villegas et al., 1994*).





**A**  
**NW**

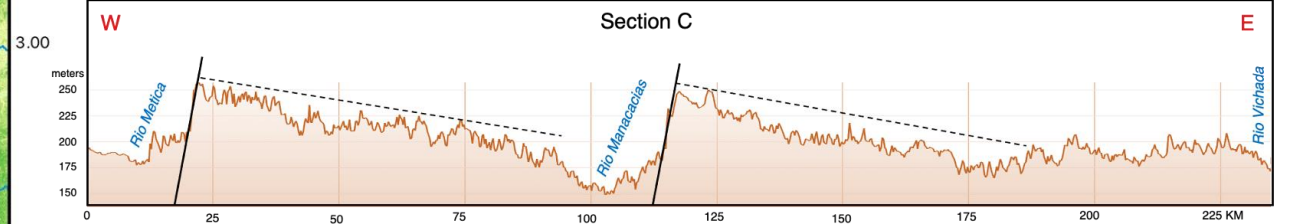
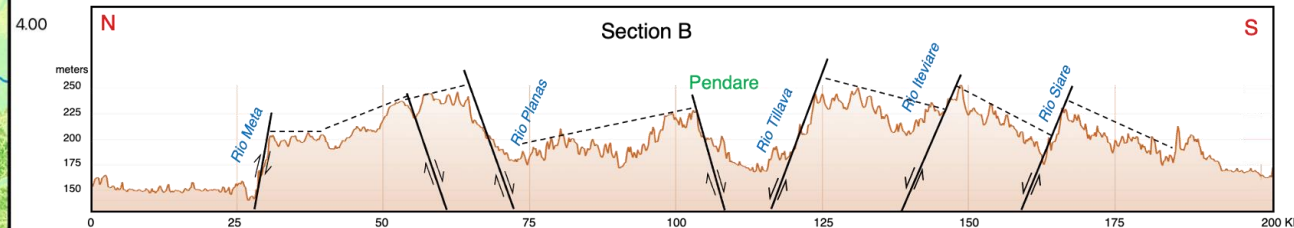
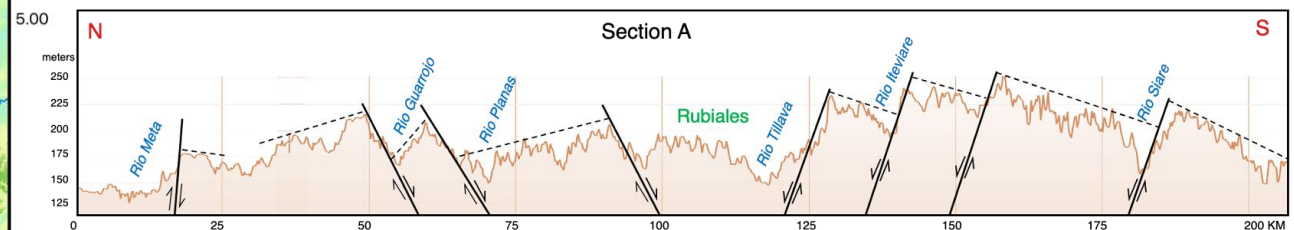
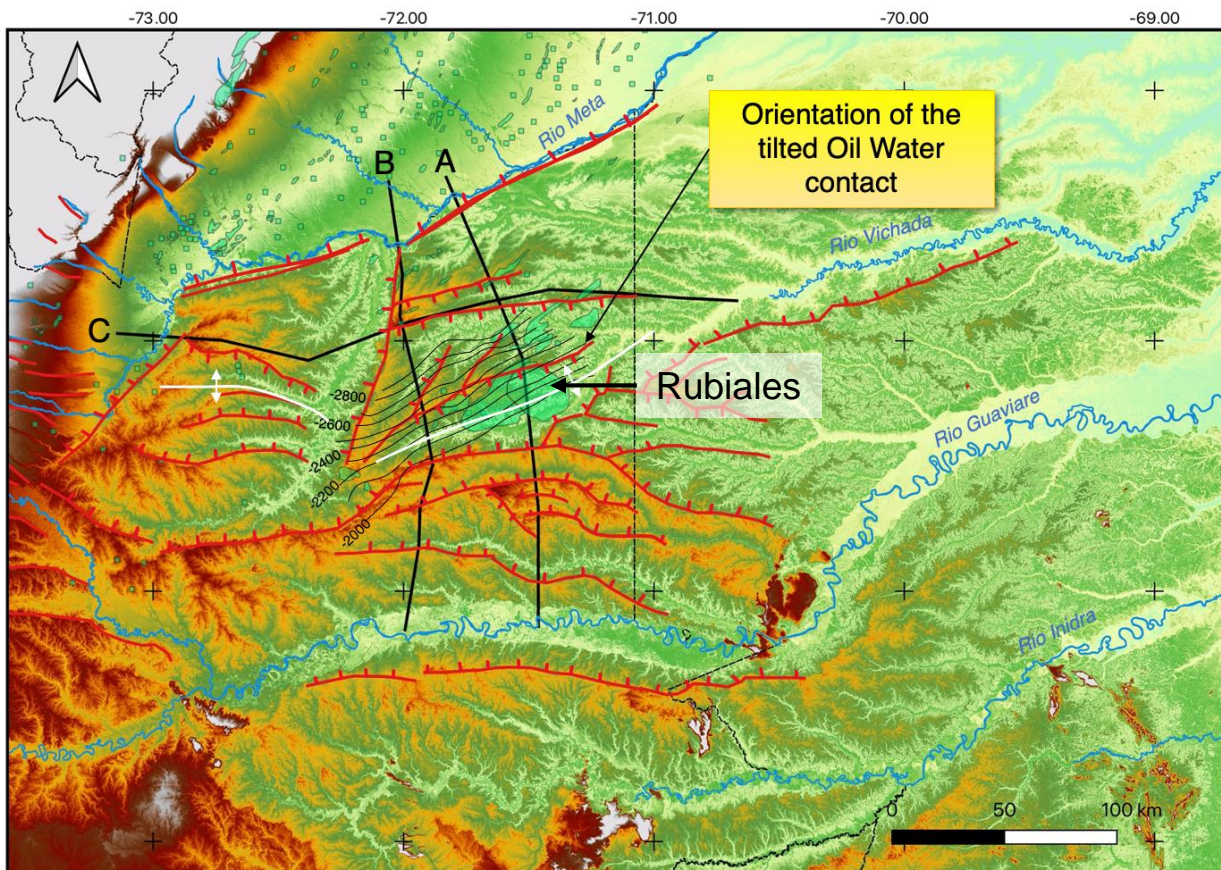
**A'**  
**SE**

**A** Llanos piedmont

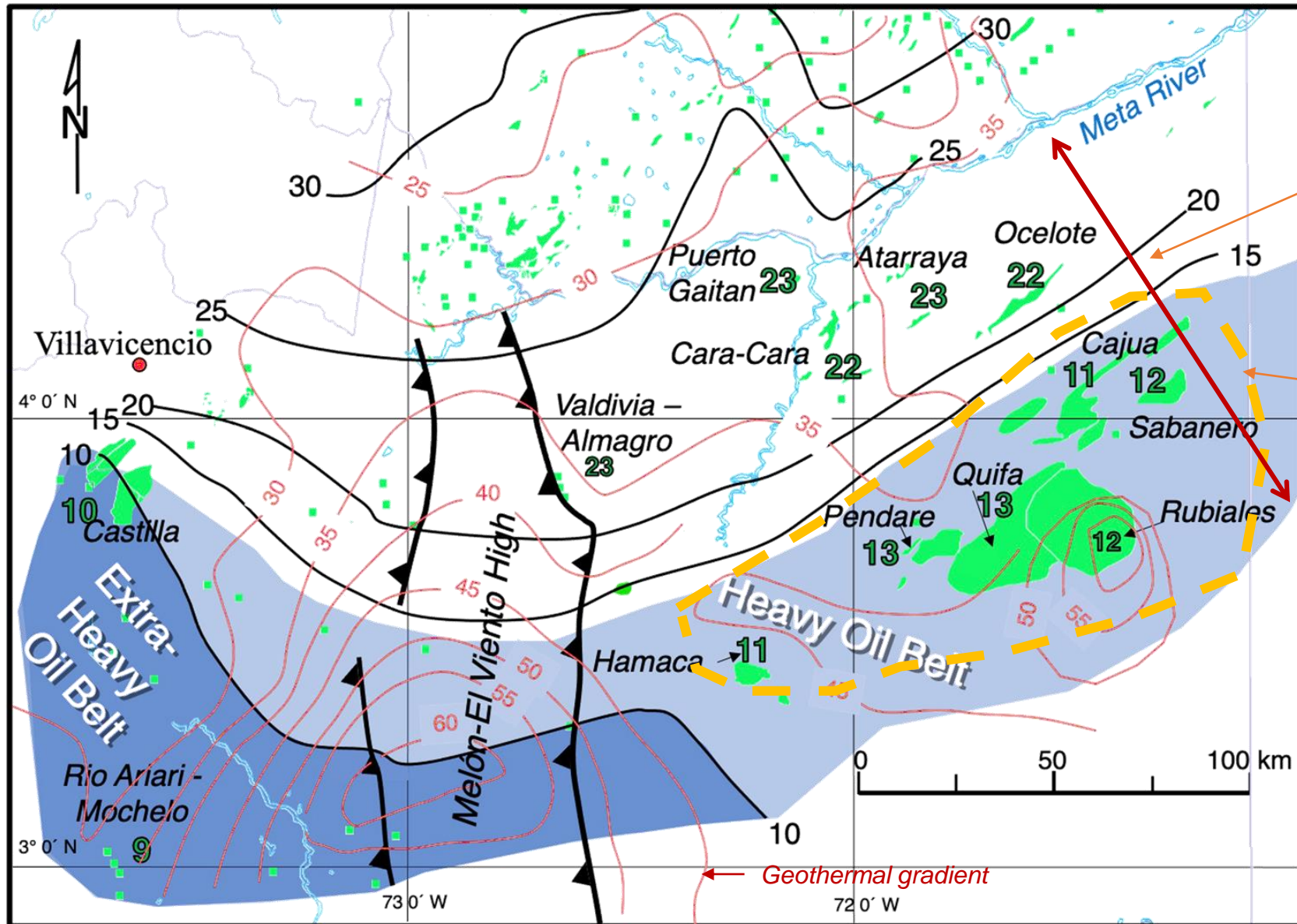
Area of uplift (Peripheral Bulge)

**A'**





# Distribution of oil gravity in the southern Llanos Basin

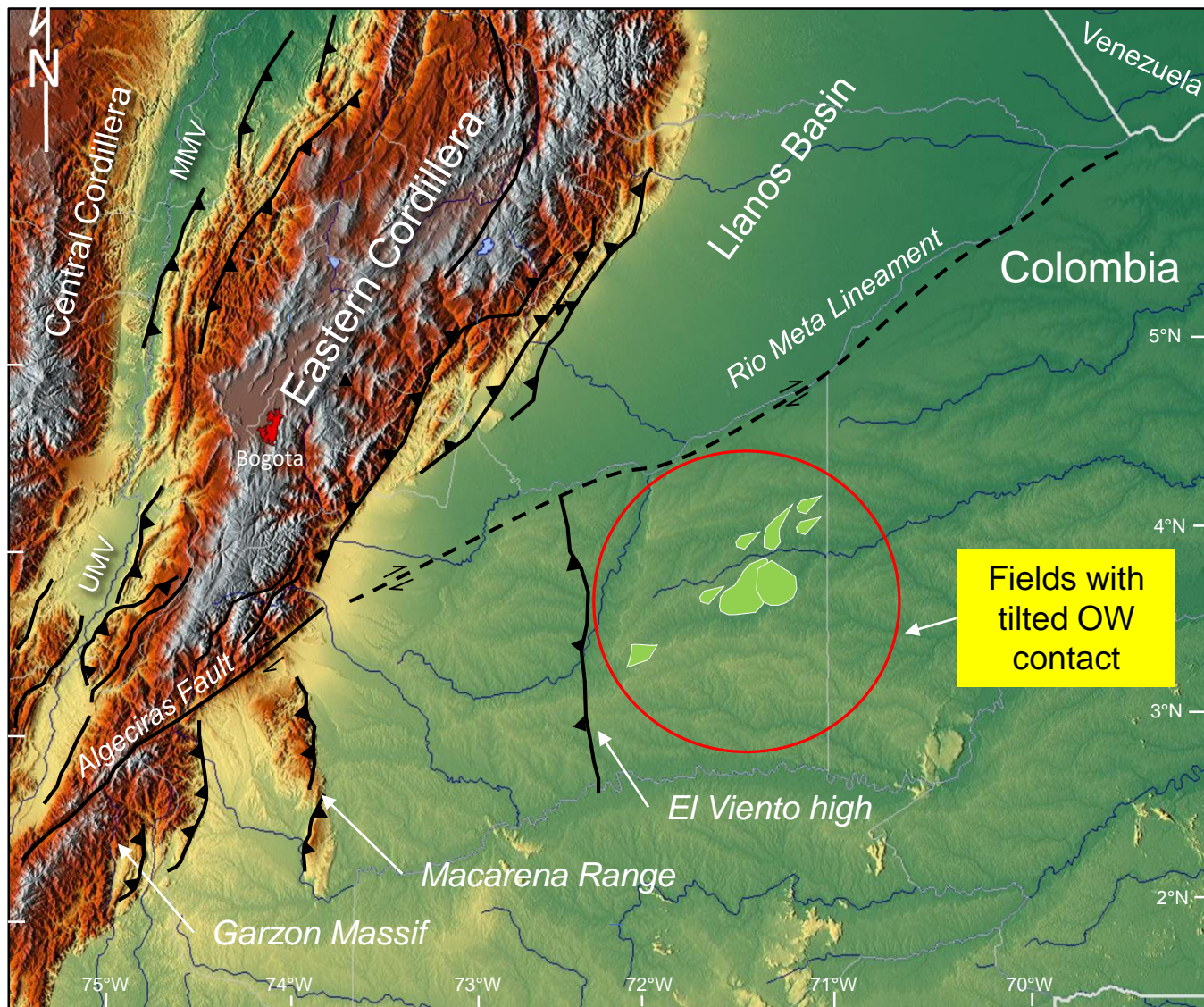


Area of recent uplift

Fields with tilted OWC

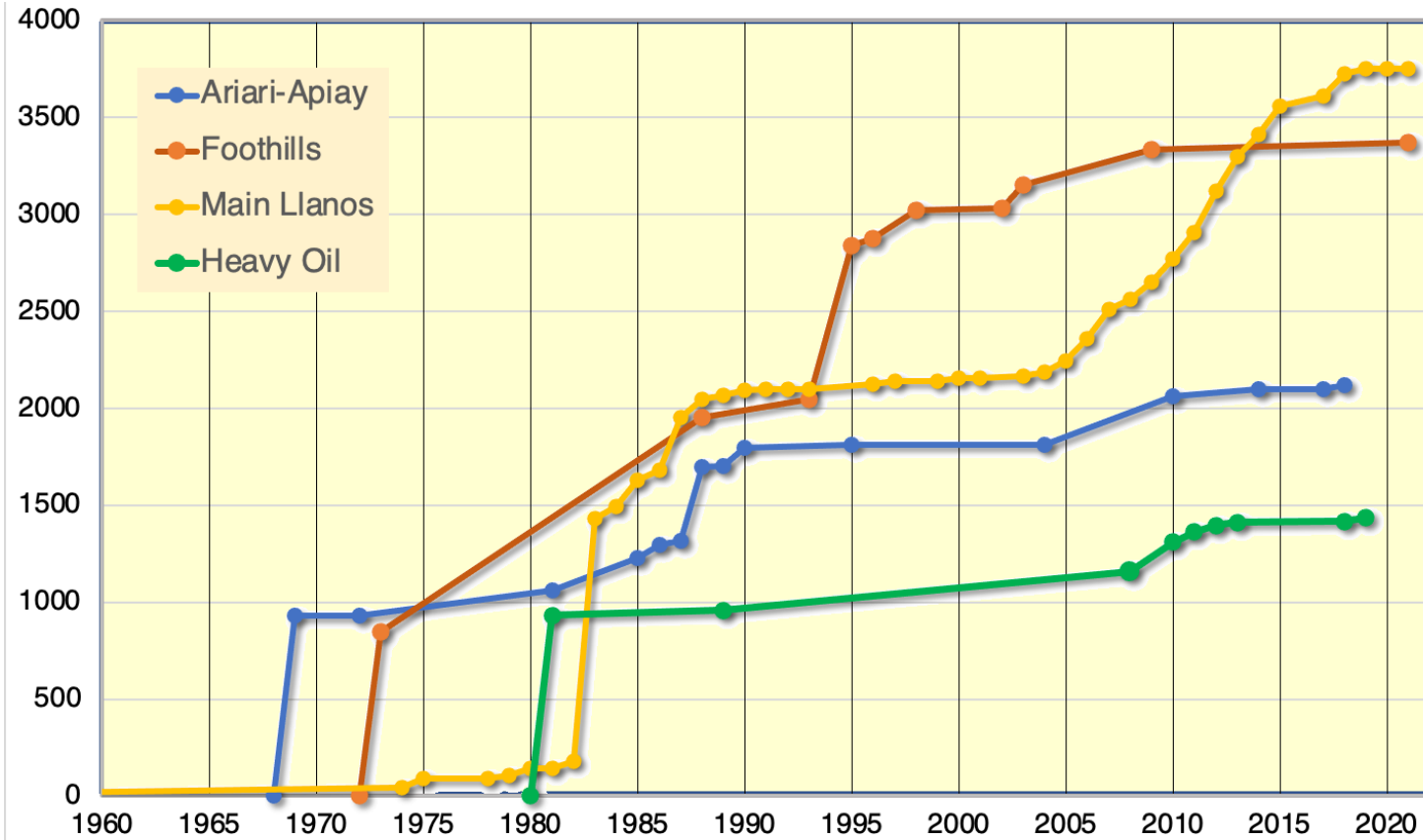
Geothermal gradient

Modified from Bachu et al., 1995, Garcia et al., 2015 and Mora et al., 2019



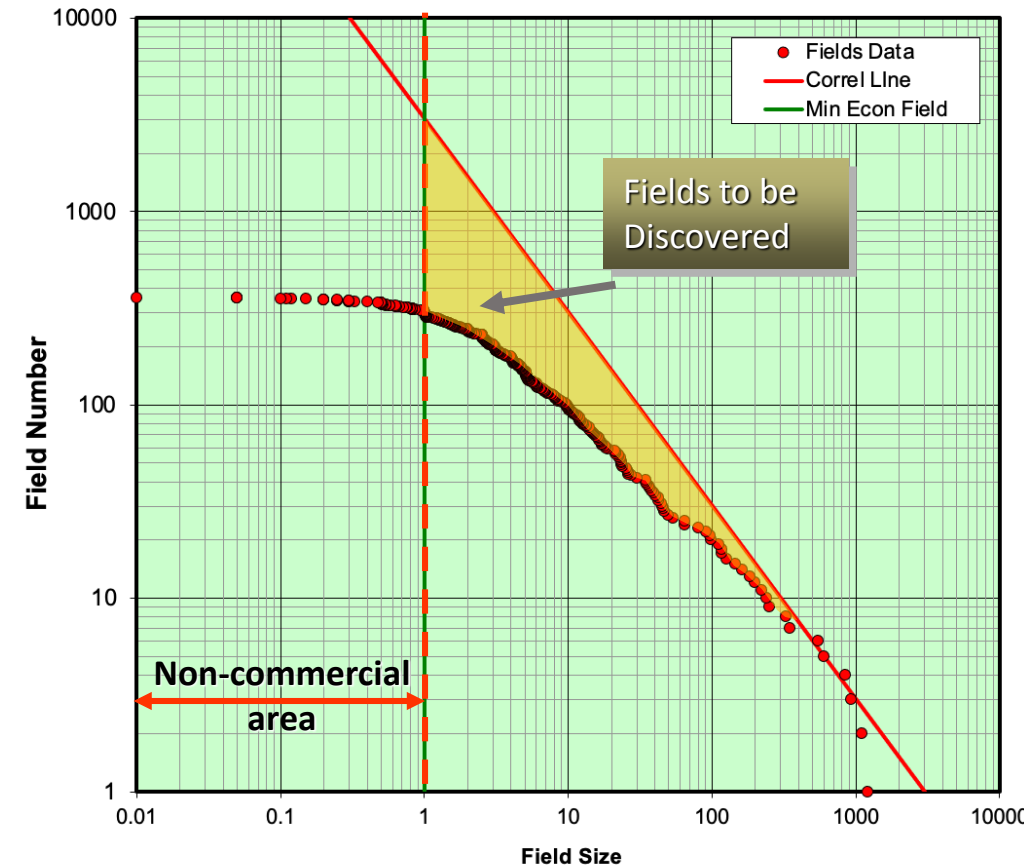


## Creaming Curves by Play



## Yet to Find

Llanos Basin Yet to Find MMBOE (MMbbl)



15.1 BBO

- A total of 3.5 Billion BOE were found in the different basins of Colombia since 2010, highlighting the exploration potential of the country.
- The largest discoveries were made in the Llanos Basin (mostly oil) and in the Offshore Sinu Fold Belt (gas), but important discoveries of gas were made in the Lower Magdalena Basin, and of oil in the Middle Magdalena and Putumayo basins.
- Several new plays were discovered in the **Llanos Basin** within the last 10 years, and there are still large areas without adequate seismic coverage. In addition some of the new plays are just beginning to be explored.
- The **Offshore** potential mostly for gas needs to be economically realized in the next years.
- Colombia has a tremendous potential for **Unconventional Resources**, particularly in the Middle Magdalena Basin and this could be a game changer for the country in the next years if the above surface issues are resolved.



# Akcknowledgements and Disclaimer

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I would like to thank IHS for providing information on the latest discoveries, and to Ecopetrol for information on the offshore activities.

The concepts and views expressed here are the sole responsibility of the author

