



# AREAS ADVERTISEMENT 2022

Giant Gas Potential In Cretaceous Rocks Along The Eastern Cordillera Of Colombia

July 8, 2022

# Giant Gas Potential In Cretaceous Rocks Along The Eastern Cordillera Of Colombia

Cesar Mora

Geologist MSc Petroleum Systems

**Hydrocarbon Potential of Source Rocks Reservoirs in Eastern Cordillera Basin / UIS-ANH, 2018**

*Maria Rosa Ceron / José Fernando Osorno / Cesar Mora / Claudia Posada / Miguel de Armas / José Urueta*

**Hydrocarbon Potential of Source Rocks Reservoirs in Colombia / ANH, 2019**

*José Fernando Osorno / Cesar Mora / Claudia Posada / Cristian Peñafort / José Urueta / Mario Barragán*

**Eastern Cordillera Basin, Geological Integration, Evaluation of Oil Systems and Prospectivity / UPTC-ANH, 2020**

*Hugo Buitrago / Kurt Bayer / Carlos Julio Rodriguez/Luis Vergara/ Andrés Mesa/ Gatsby Lopez / Helman Bonilla / Mary Piragauta / Nelly Piragauta/ Maria Murillo / Gener Bautista/ Juan Guarín / Leady Caro / Aldemar Cardozo / Cesar Mora*

**Gas Prospectivity Evaluation In The Colombian Onshore Basins With Commercial Production / UPTC-ANH, 2020**

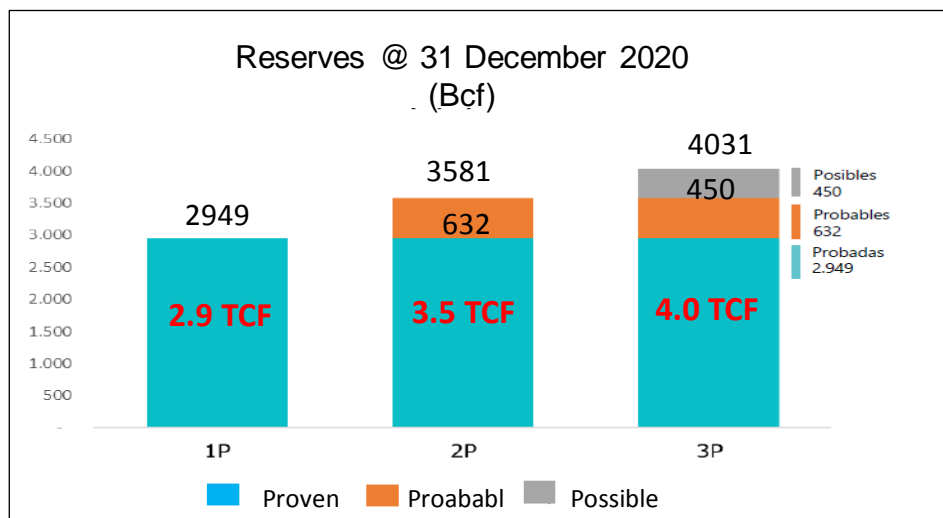
*Nelson Lizarazo / Carlos Julio Rodriguez / Clara Elena Escobar / Cesar Mora / Antonio Rangel / Luis Naranjo / Belén Silveira / Jose Pedro Mora / Juan Guarín /Nelly Piragauta / Diana Moreno / Gisela Cifuentes /Edgar Espinosa / Luis David Mesa /Boris Villa / Patricia Mantilla / Alberto Cisneros*

**Geological Habitat prospectivity socio-environmental and economic sustainability and wet gas (LPG) in Colombia as energy transition fuel/ UPTC-Minciencias-ANH, 2022**

*Mauricio Bermudez / Cesar Mora / Laura Carrero / Jorge Mariño / Hector Fonseca / Sandra Manosalva / Claudia Posada / Jhon Muñoz / Patricia Chajín / Juan Guarín Belén Silveira / Ana Rodriguez / Viviana Guarín / Santiago Mora / Nicole Mikly / Fabian Castillo / Alexandra Sarmiento*

# Current Natural Gas Reserves (2020)

Reserves @ 31 December 2020

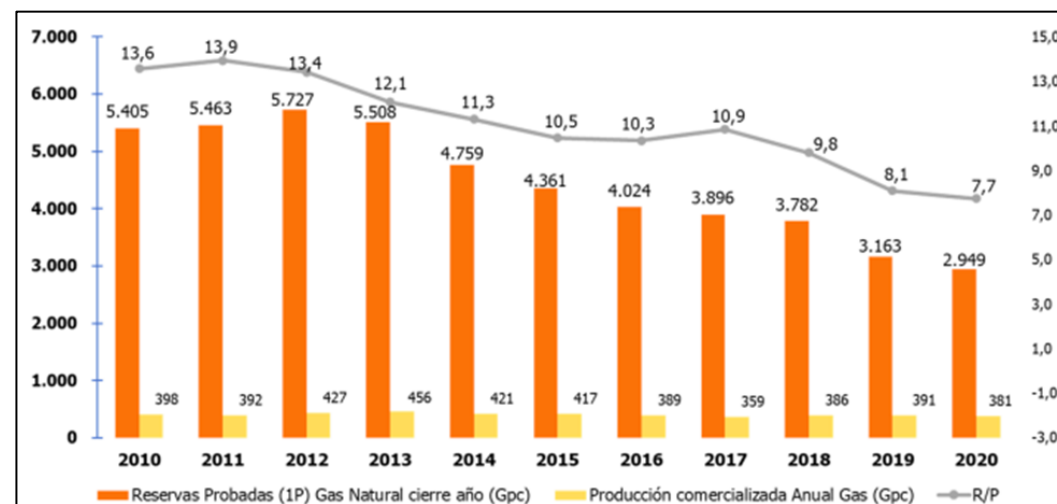
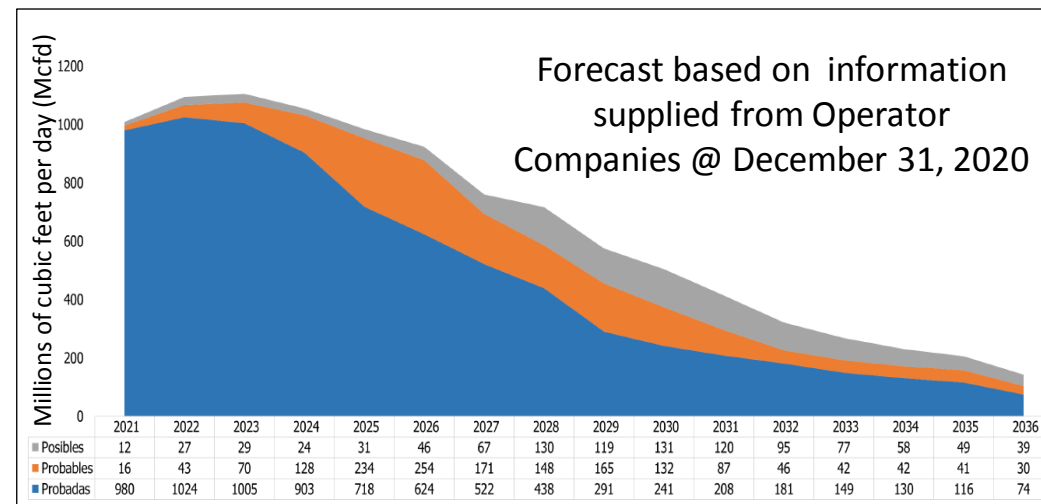


1 Bcf = 1 Gpc =  $10^9$  cubic feet

## REMARKS

- P1, P2 and P3 reserves will be depleted by 2036. Proven will be last 7,7 years If R/P is < 6 years, it is considered that country has not enough gas reserves
- There are a growing demand in country and only two major areas represent the offer of the fuel
- Each year country must replace 360 Bcf 1P reserves for no decreasing R/P factor
- The replacement for 1P reserves for 2020 was 167 Bcf representing 44% of the annual production
- If supply does not increase, there will be an unsatisfied demand from local sources so.... What to do?

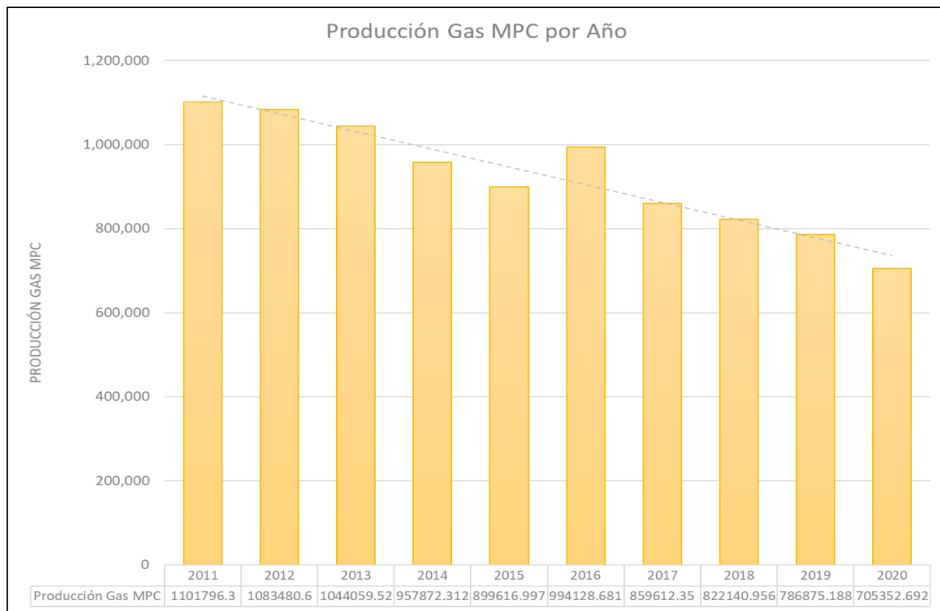
## Reserves depletion forecast



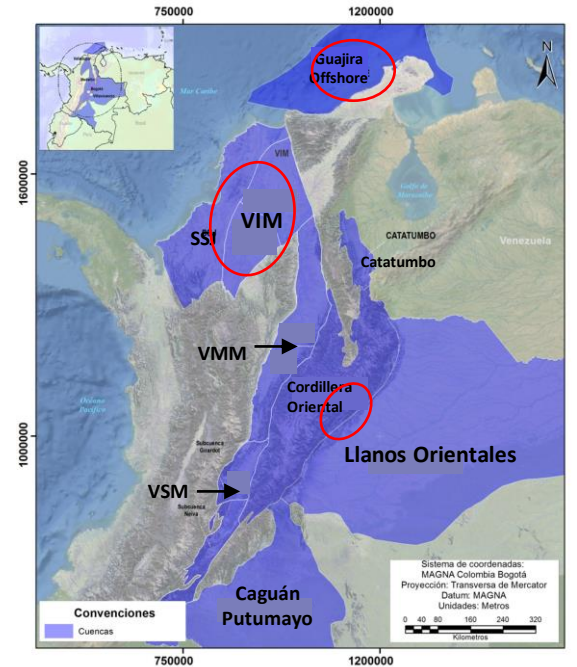
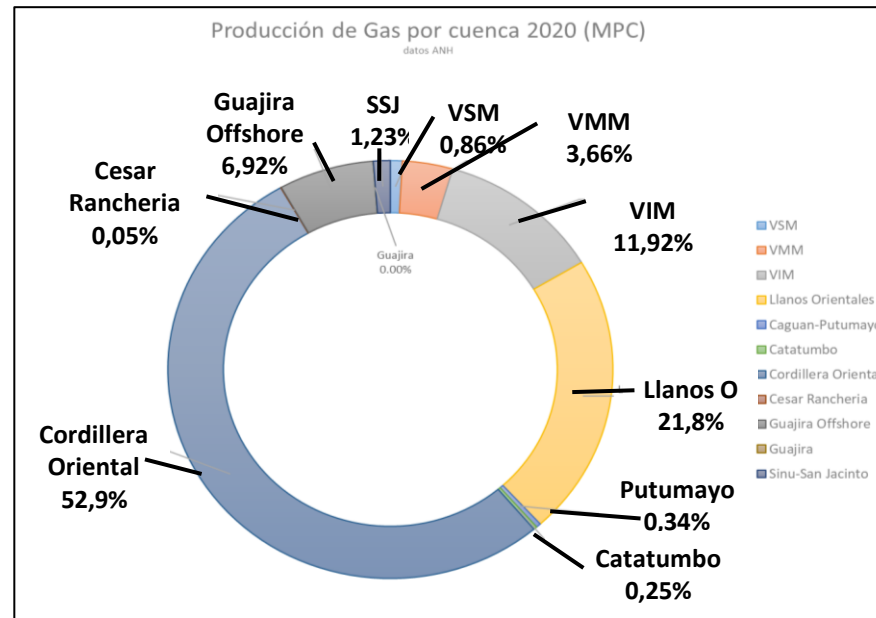
10 years behavior - P1 reserves, Commercial Production & R/P

# Current Gas Production (2021)

## Annual gas production

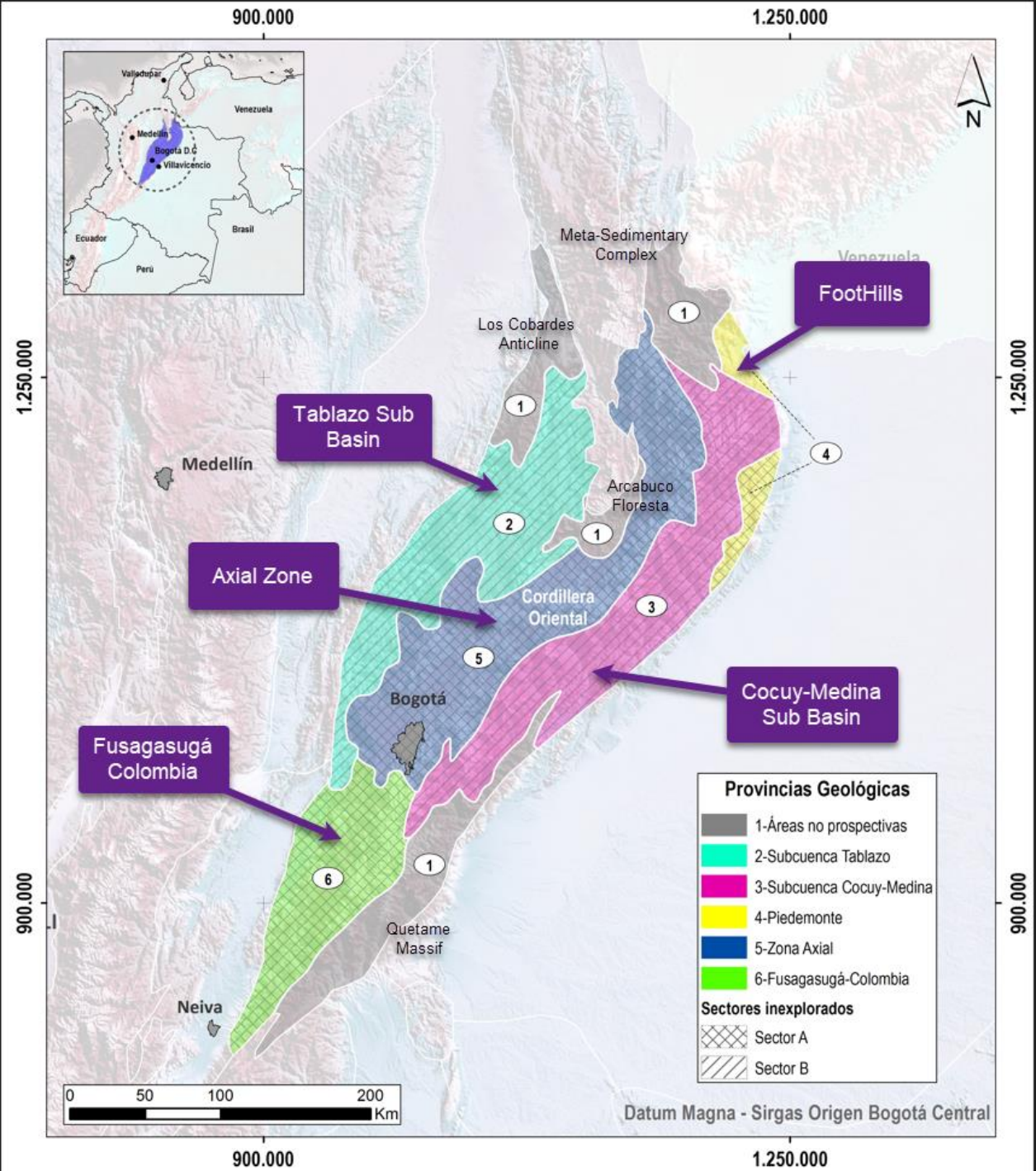
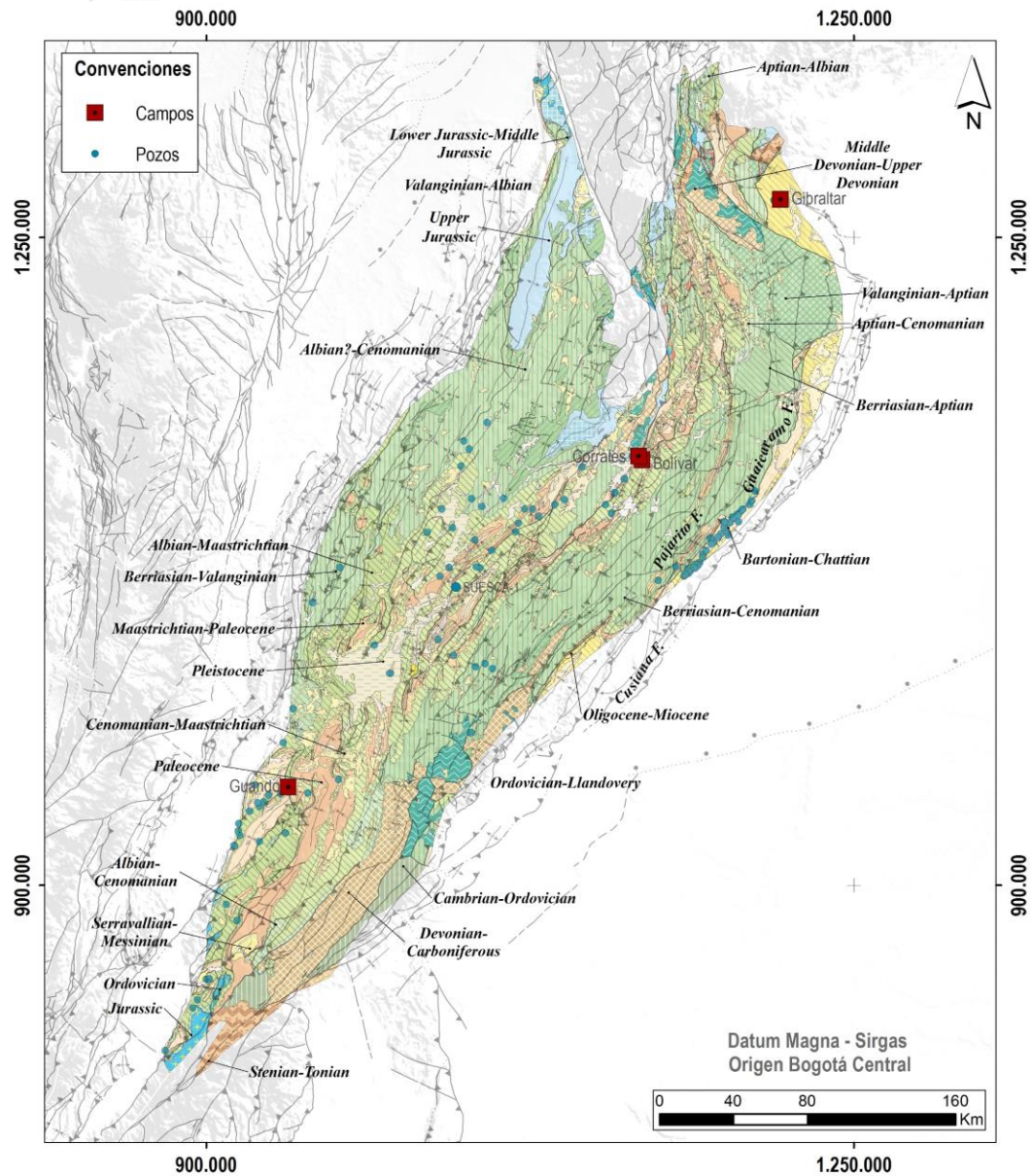


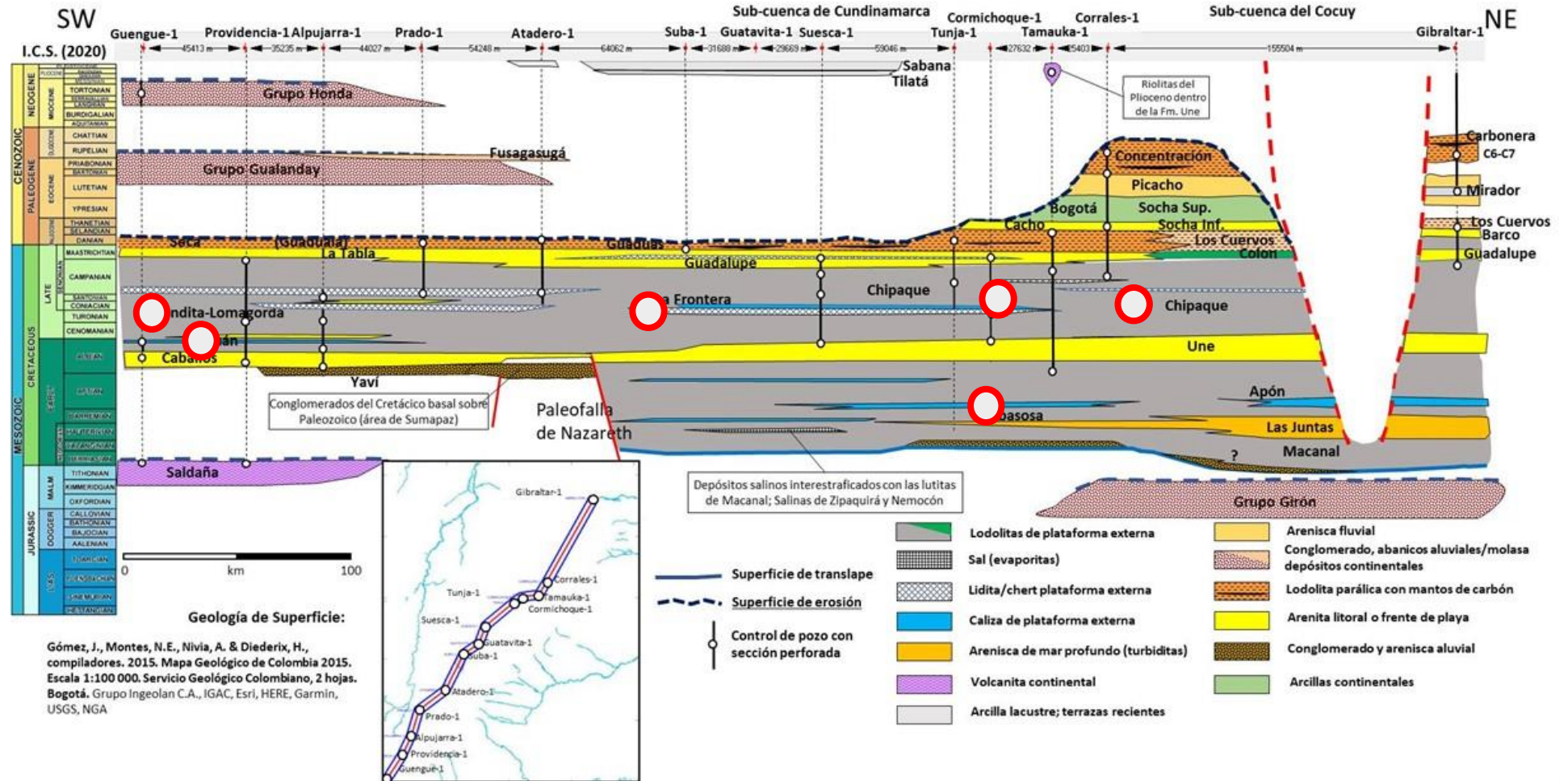
## Production by basin



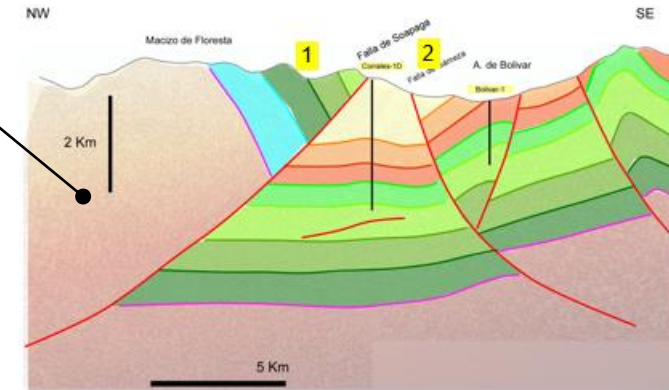
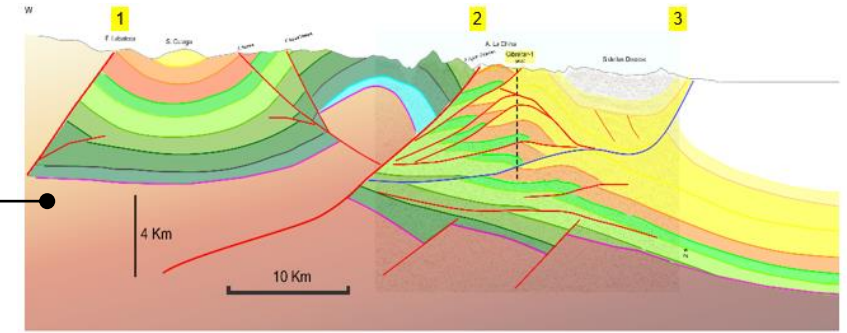
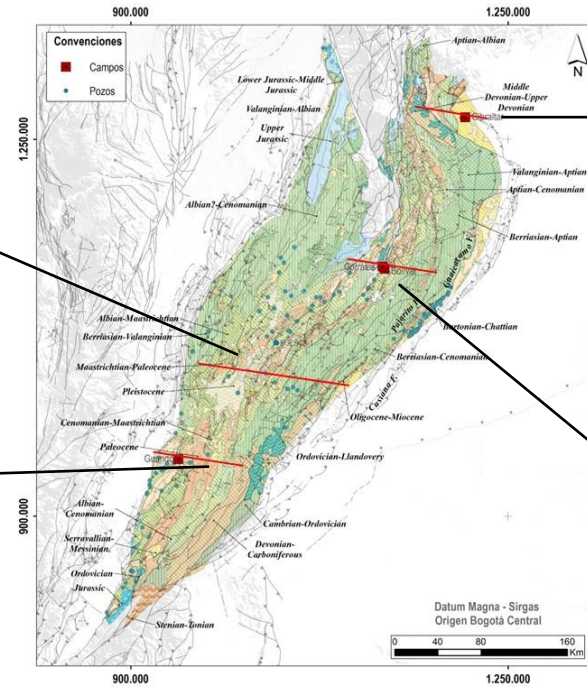
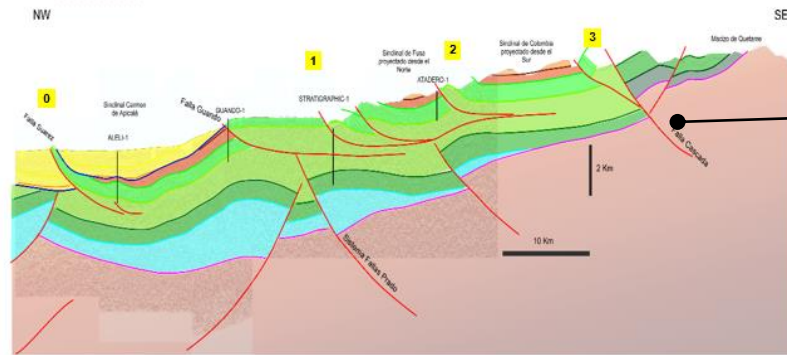
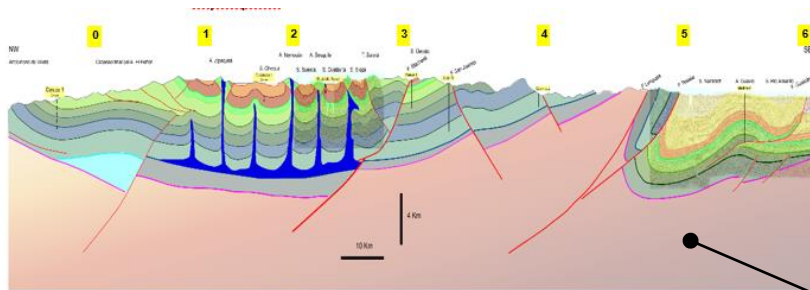
- 2020 Annual gas production was 705,353 Mcf (av 1932 Mcfd) - Non a typical year
- Gas production from 2019 to 2020 had a reduction of 10%
- 2021 total gas production was 667,427 Mcf (av 1830 Mcfd) – Reduction vs 2020 was 5.3%
- Main production is coming from Cordillera (Piedemonte - foothills -fields), Llanos (Cusiana field), VIM and Guajira offshore

# Geological Framework

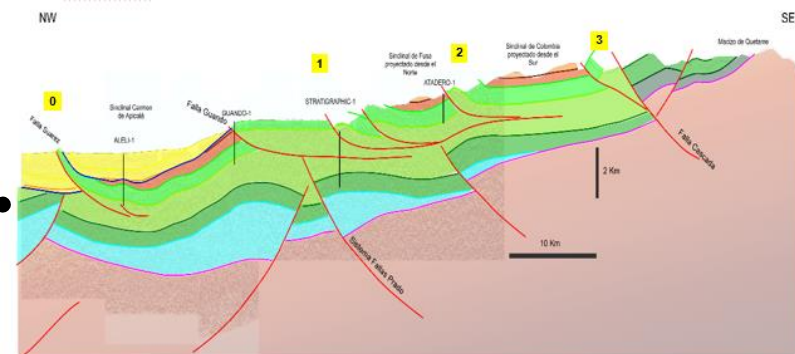
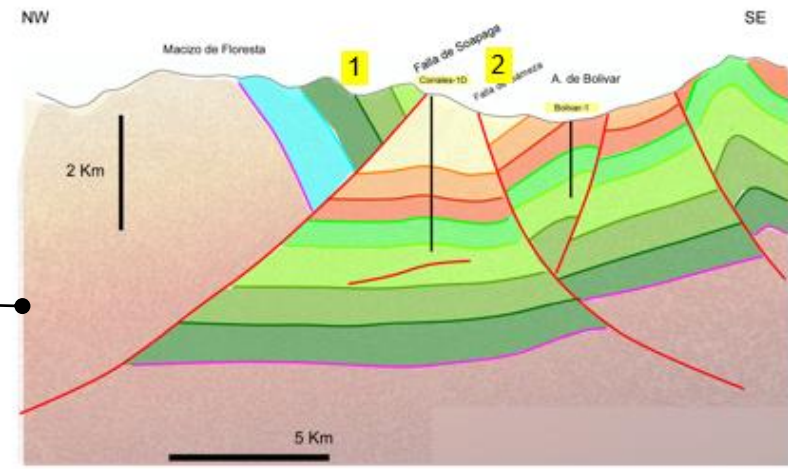
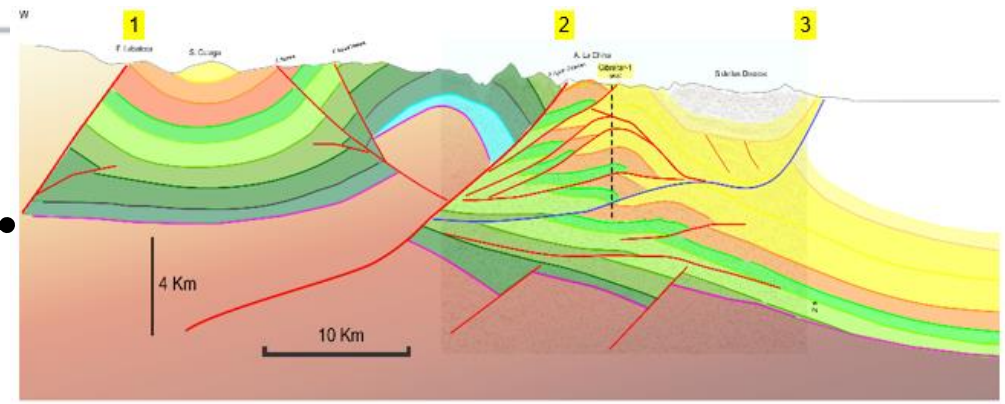
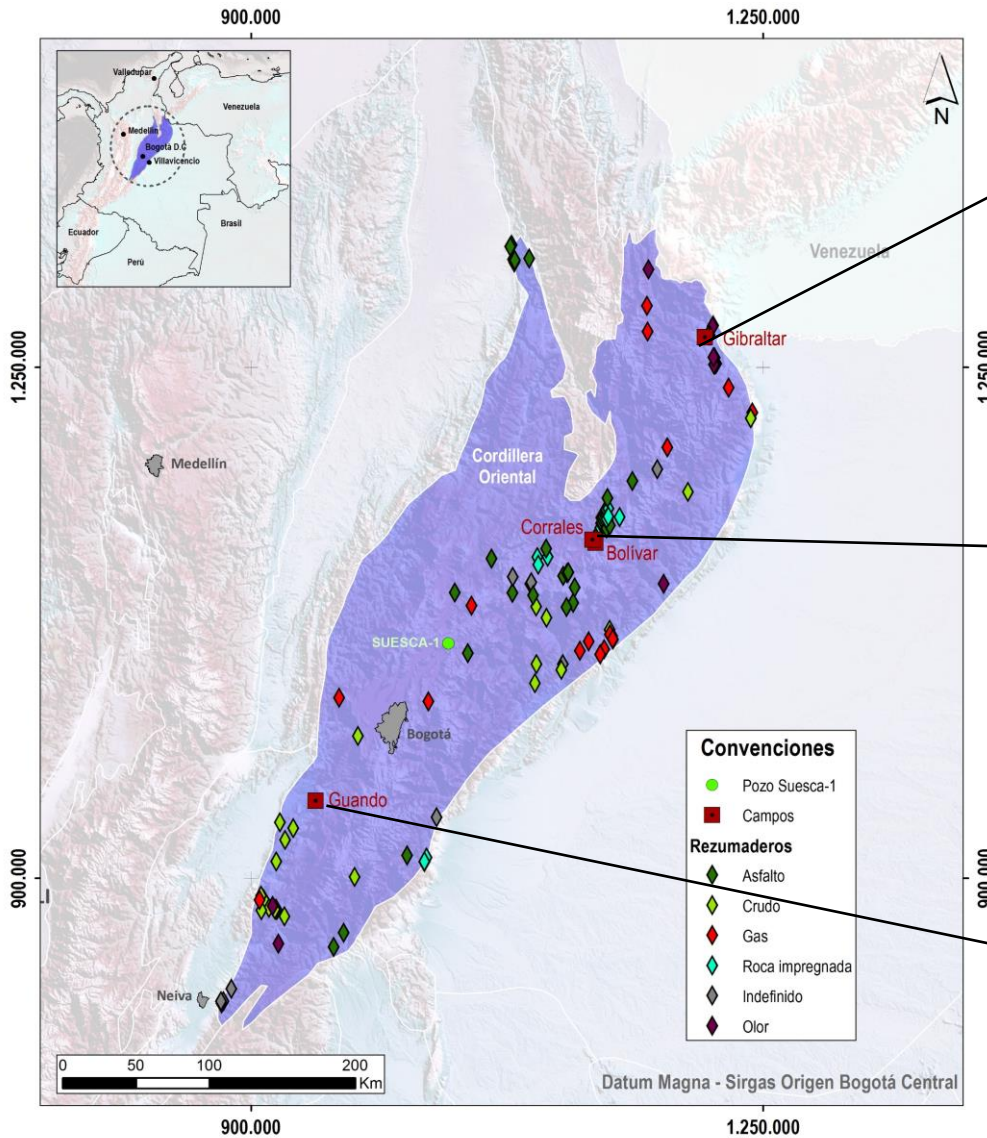




○ Source Rock Intervals

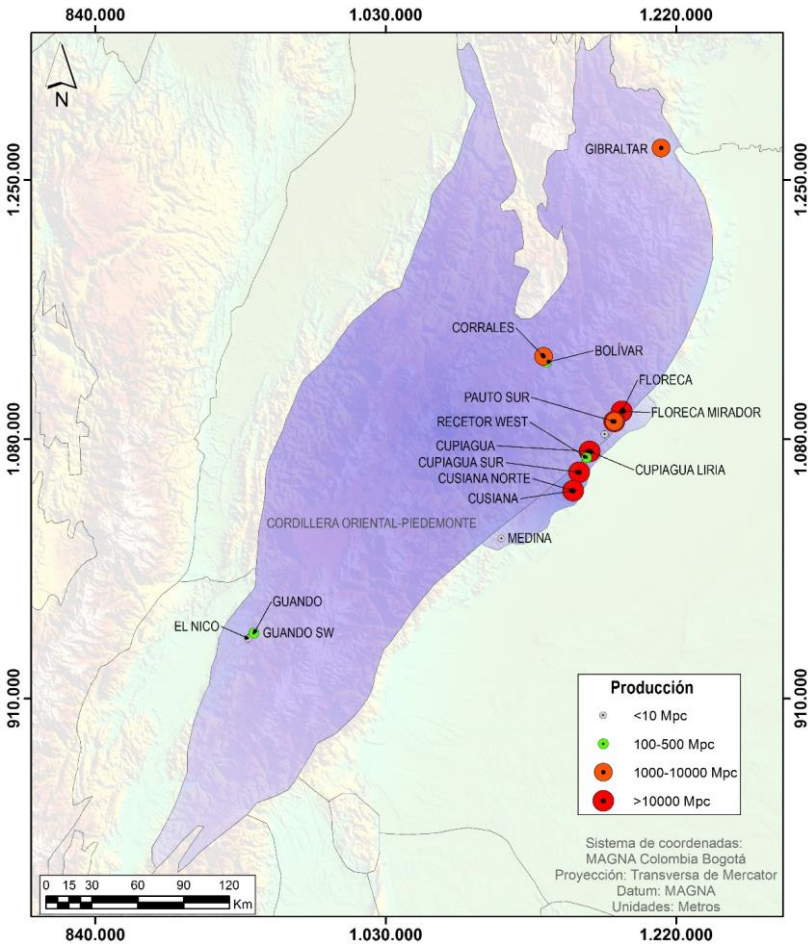


# Geological Framework & HCs Occurrence



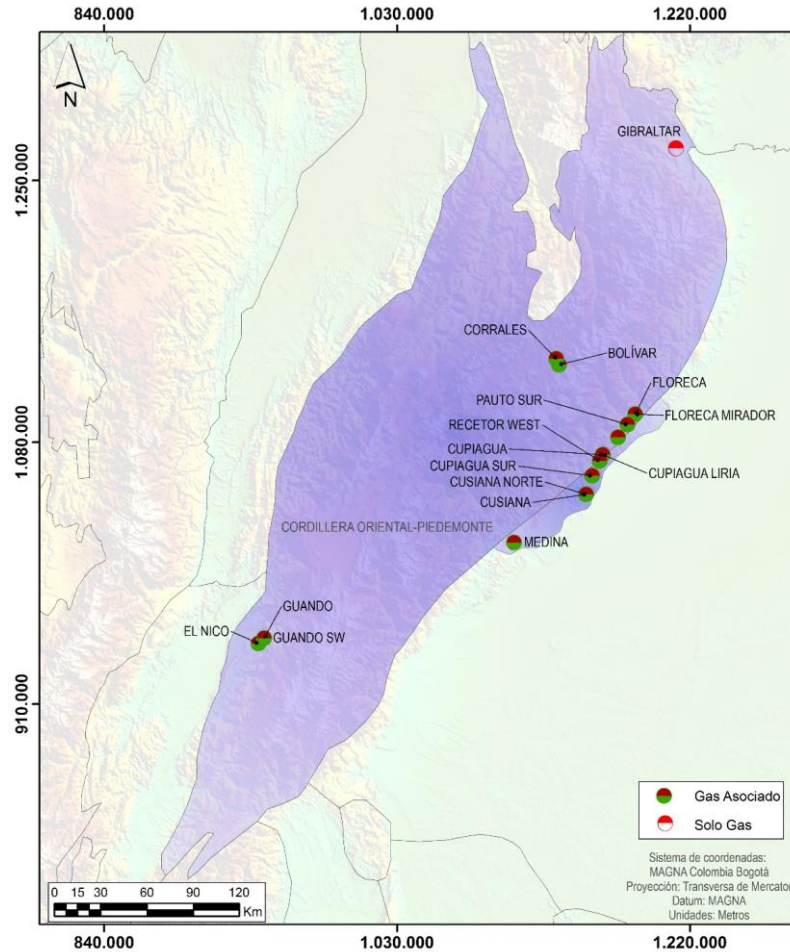


# Gas Occurrence



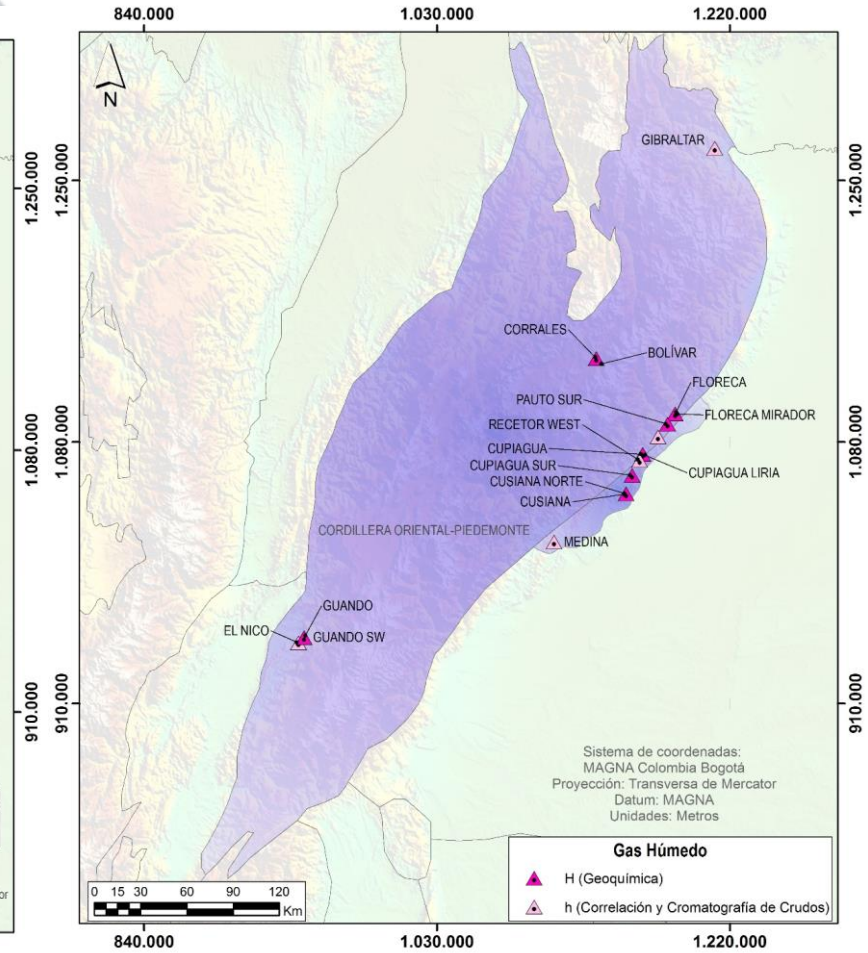
## Certified Gas

There are 18 gas producing fields and they have the highest cumulative gas production in 2021 with 470.8 GPCG (71%) Pauto sur is the largest gas producer in Colombia



## Associated Gas

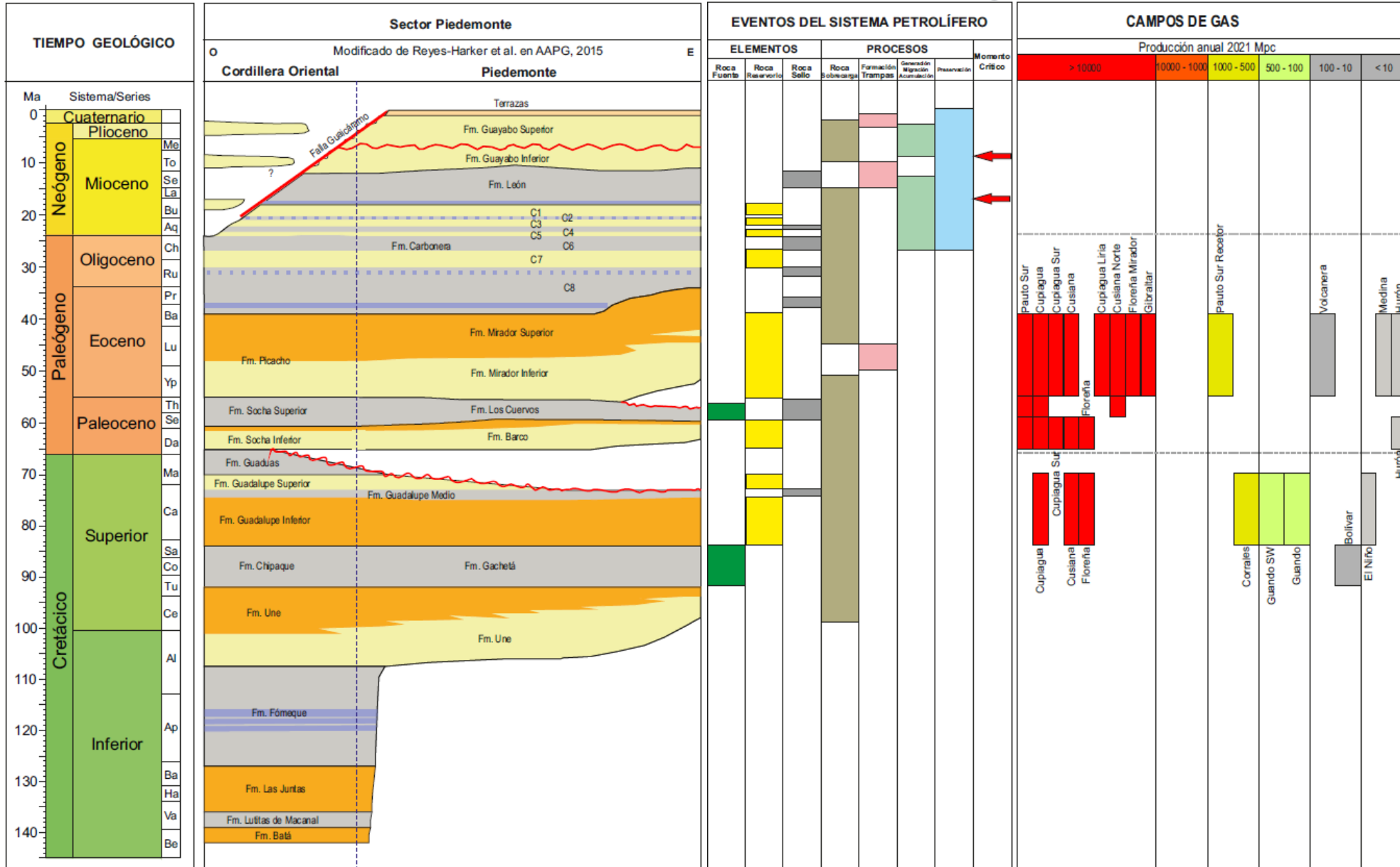
All fields produce Associated Gas except for Campo Gibraltar which produces only gas



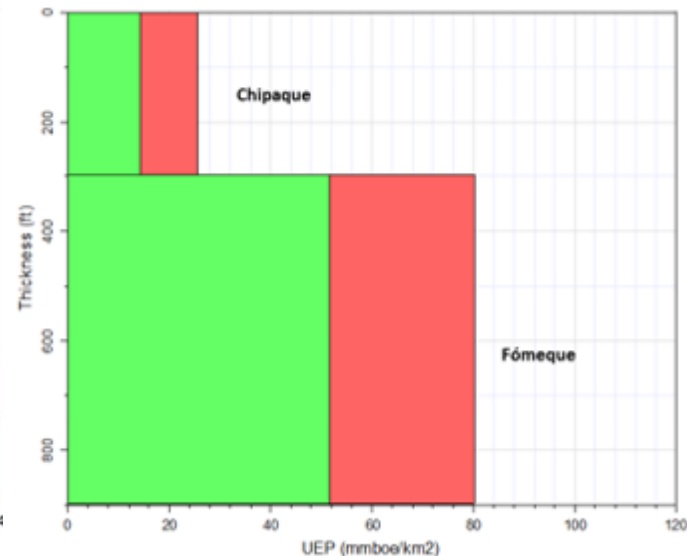
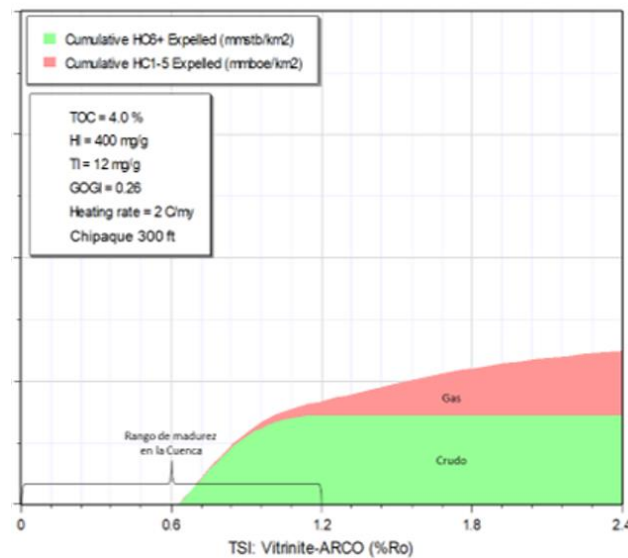
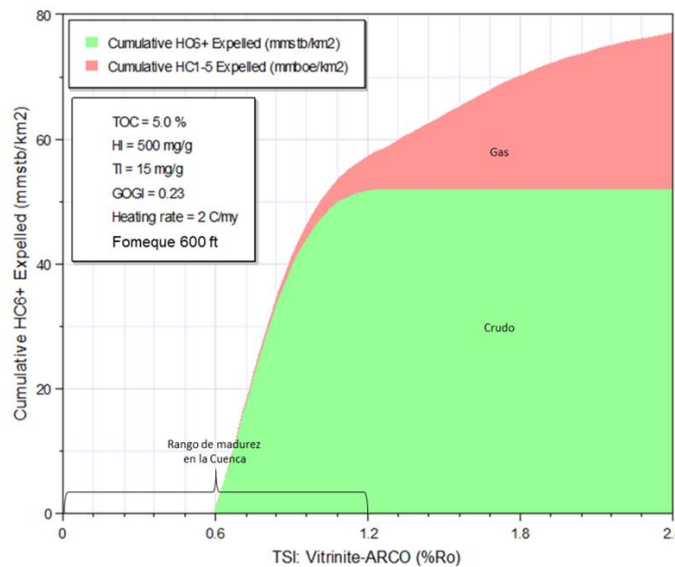
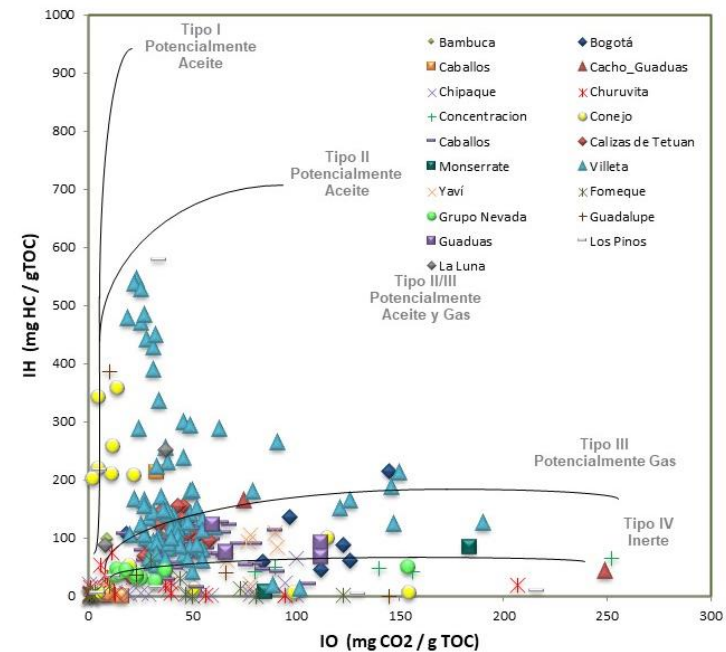
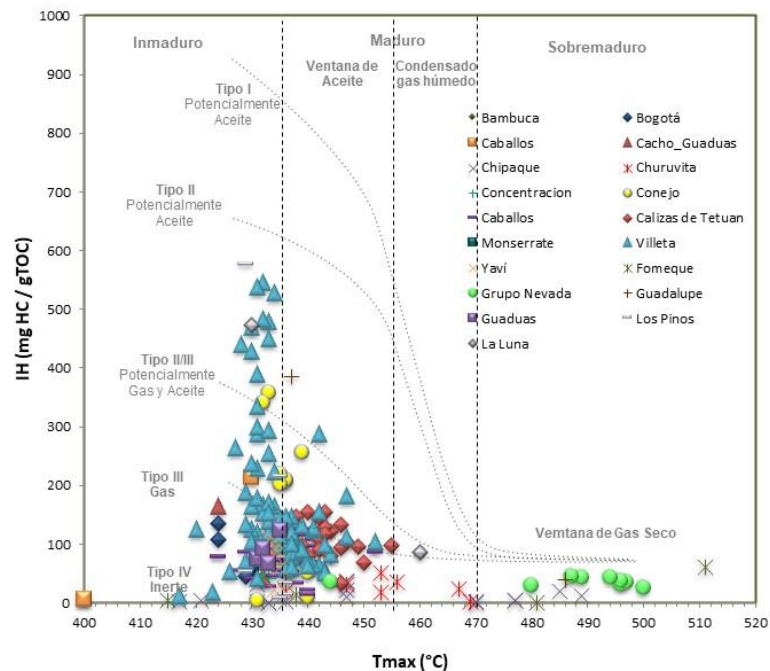
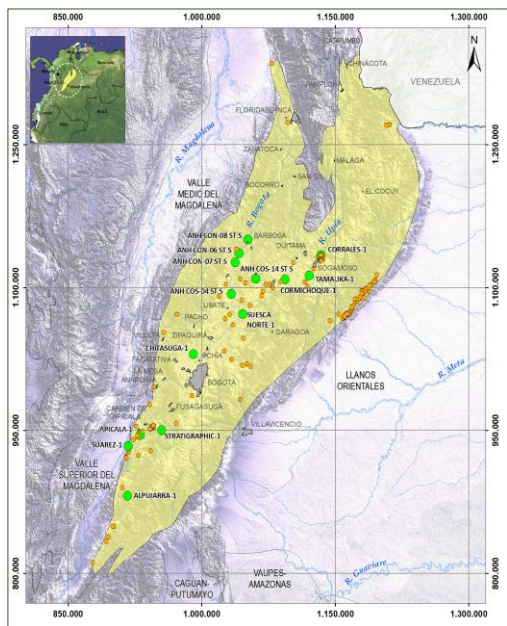
## Wet Gas

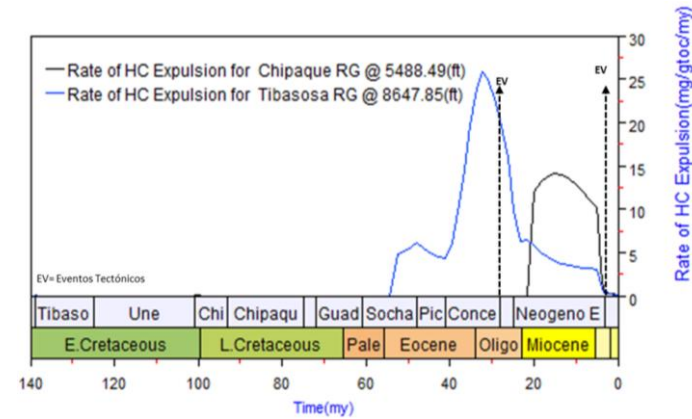
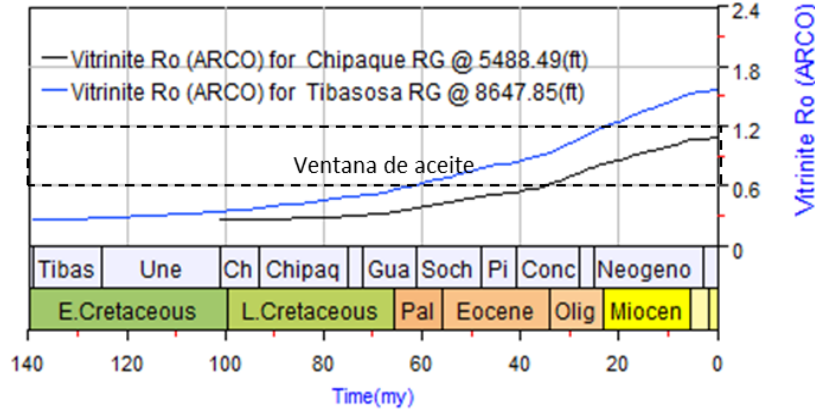
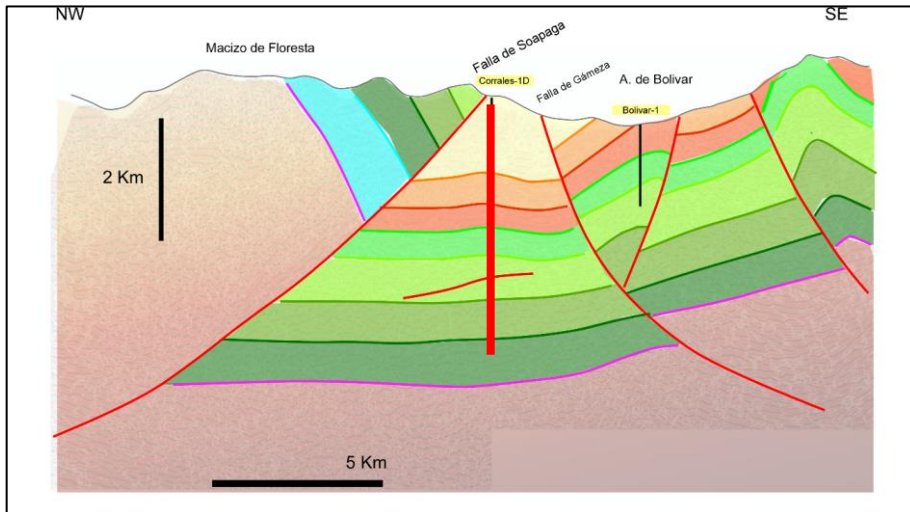
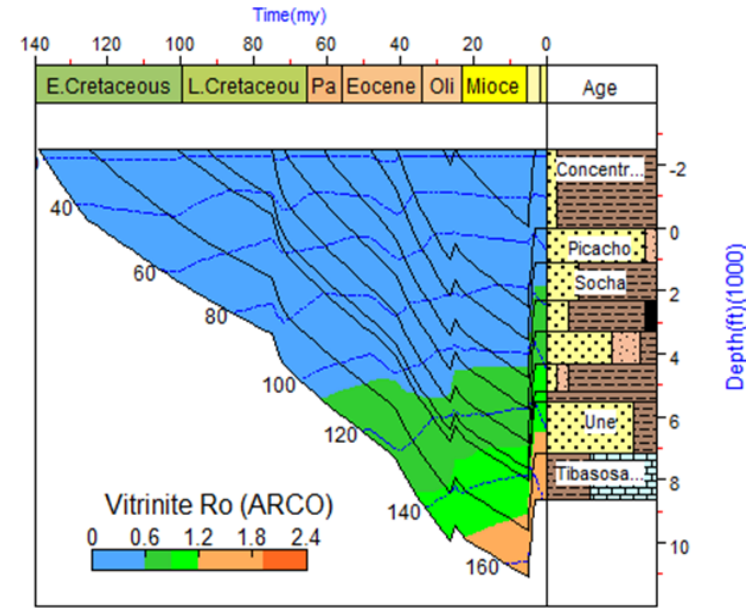
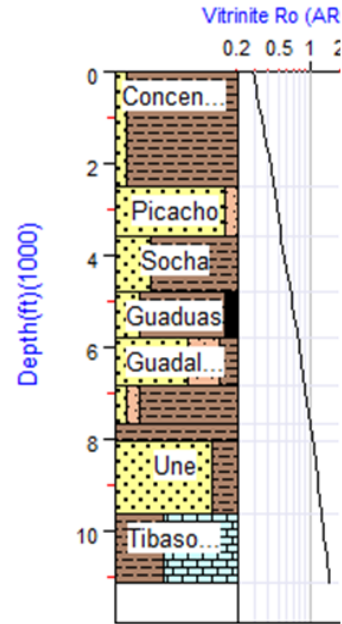
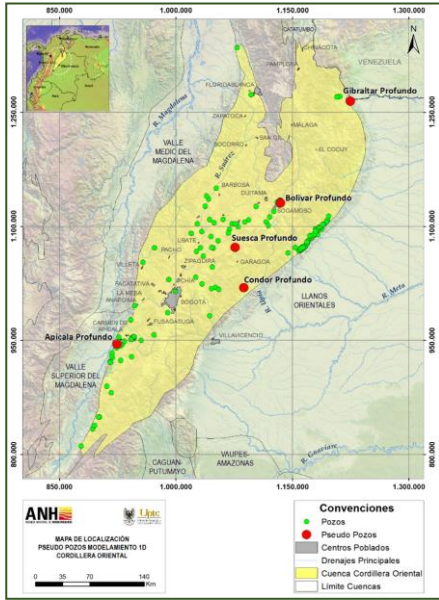
Most of the gas production correspond to wet gas The most important fields currently for LPG production in Colombia are Cusiana and Cupiagua fields.

# Geological Framework & Petroleum Systems and Gas Occurrence Cordillera-Foothills

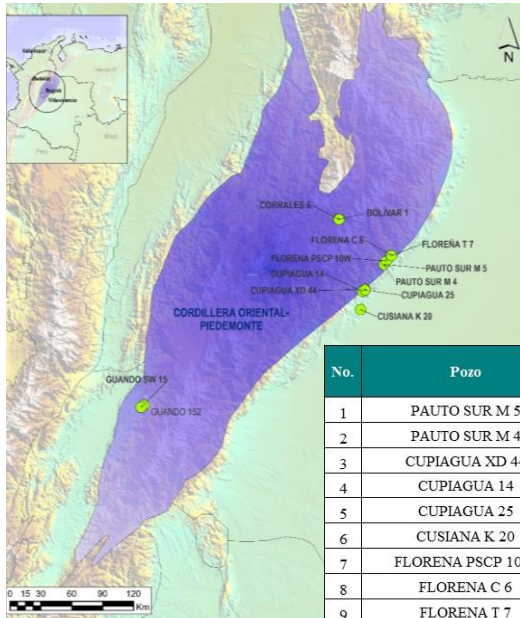


# Petroleum Systems Modeling / Source Rock Geochemistry

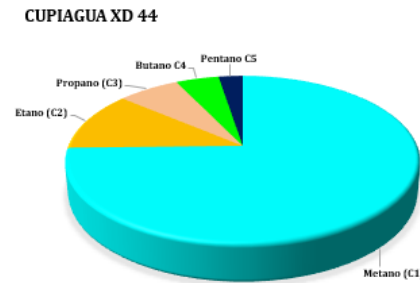
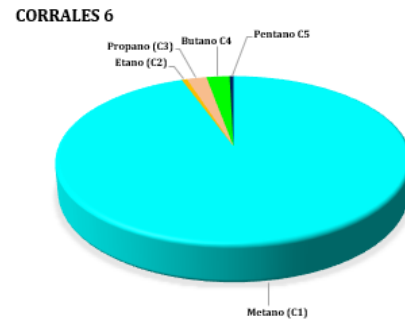
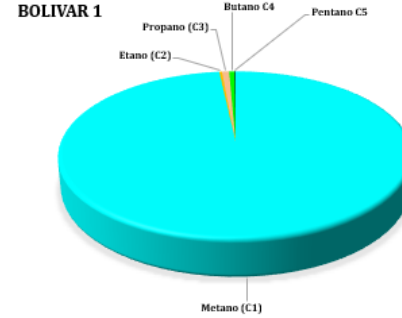
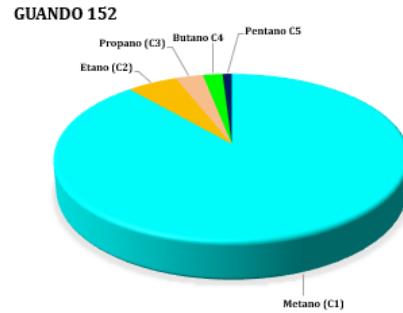




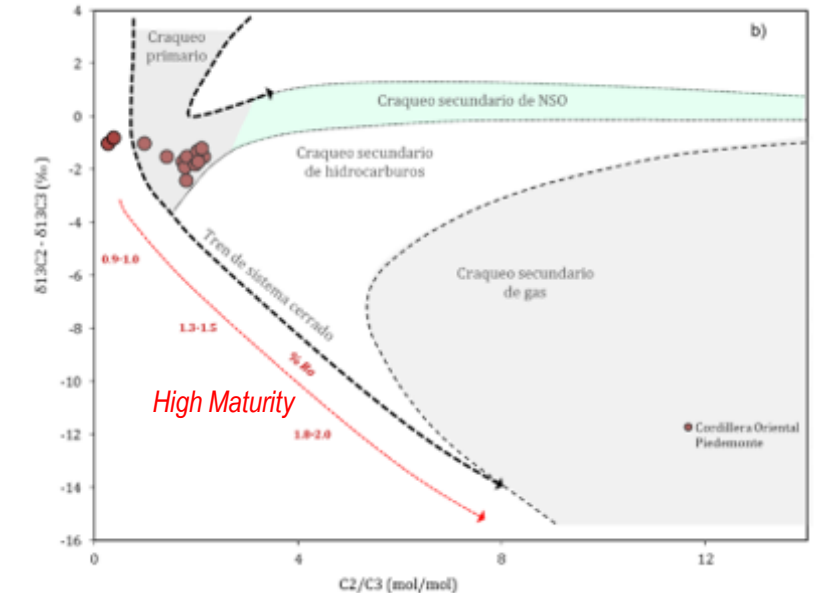
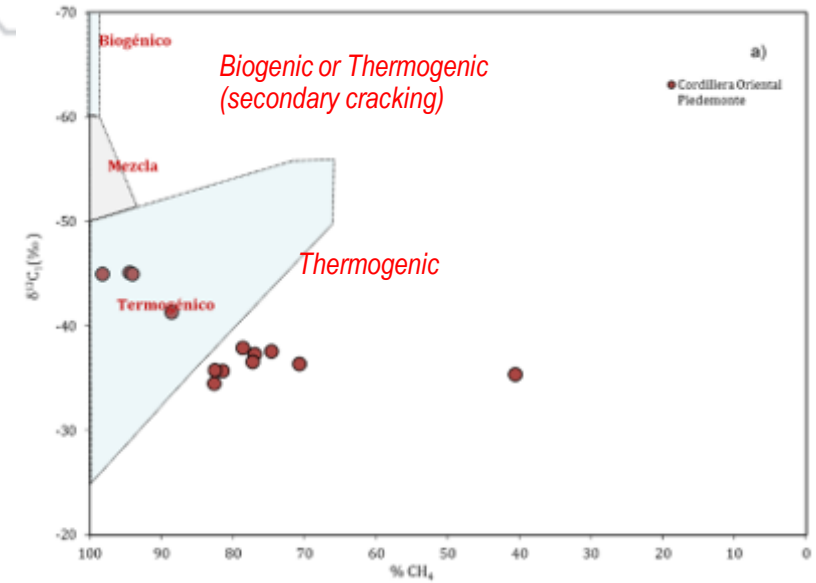
# Cordillera & Foothills / Gas Geochemistry



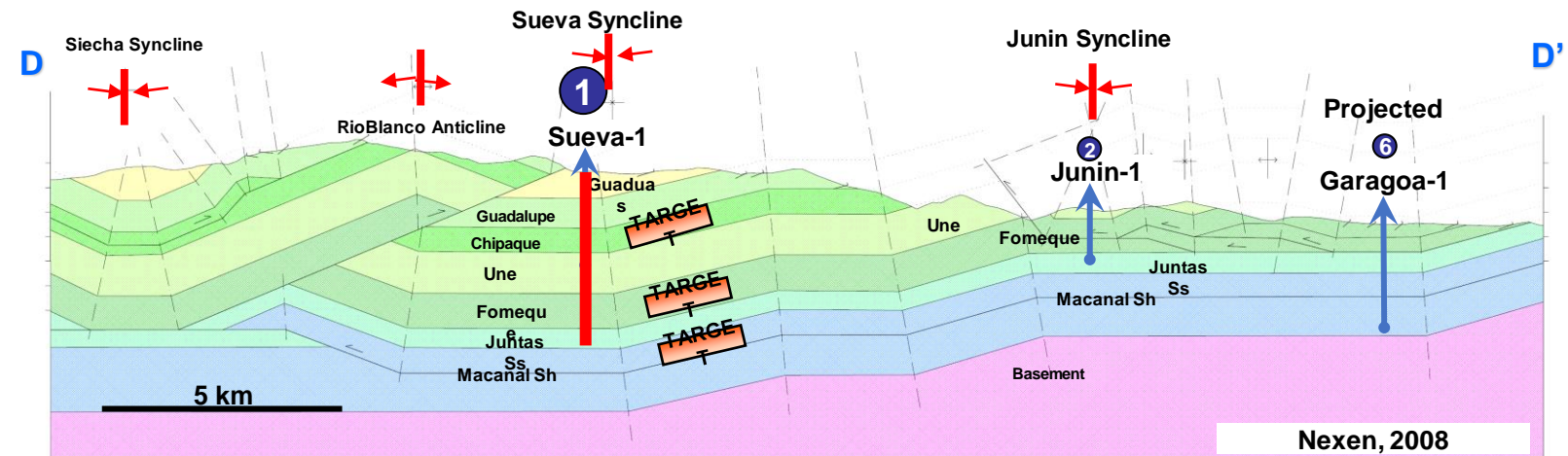
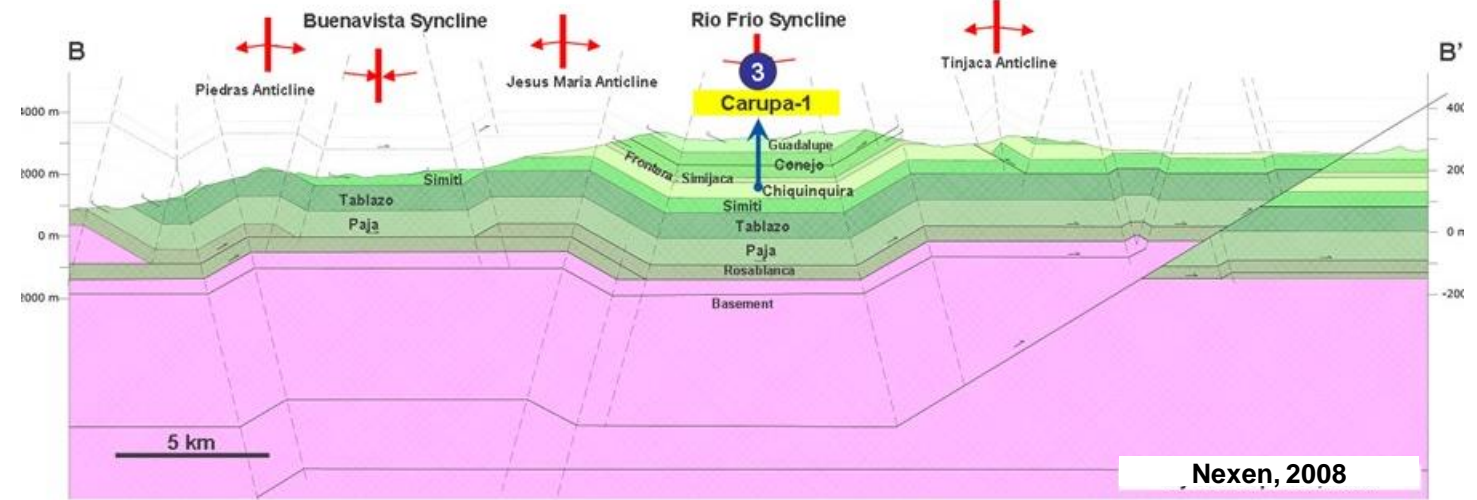
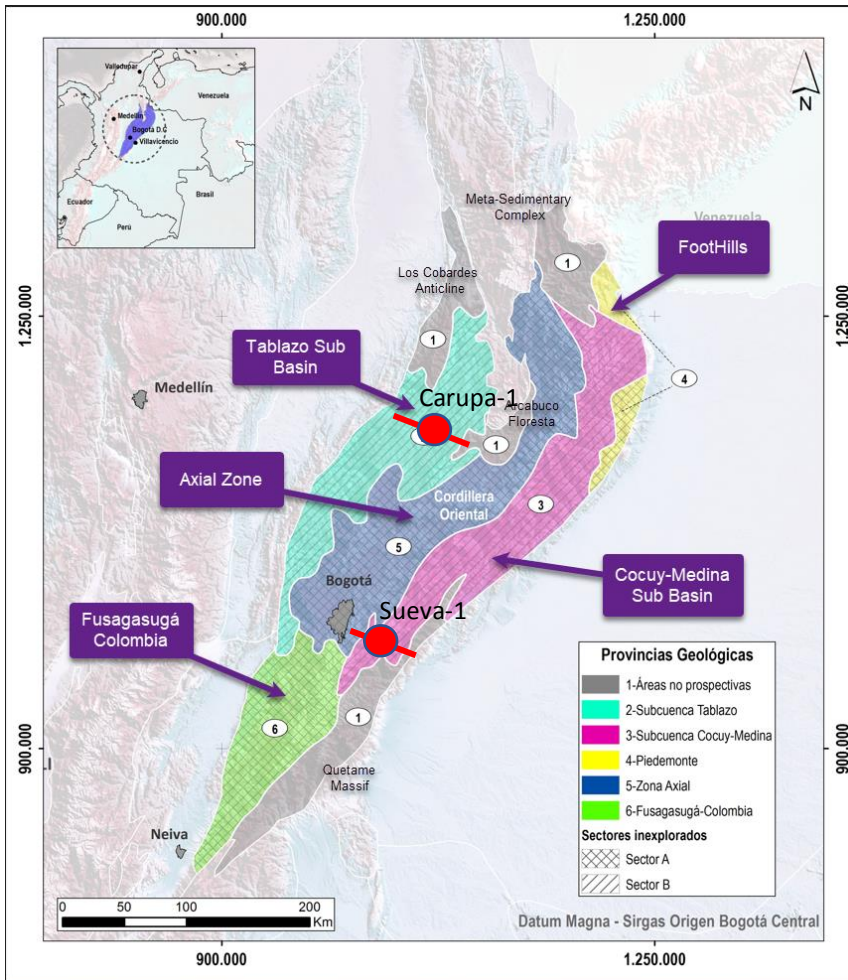
No.	Pozo
1	PAUTO SUR M 5
2	PAUTO SUR M 4
3	CUPIAGUA XD 44
4	CUPIAGUA 14
5	CUPIAGUA 25
6	CUSIANA K 20
7	FLORENA PSCP 10W
8	FLORENA C 6
9	FLORENA T 7
10	GUANDO 152
11	CORRALES 6
12	GUANDO SW 15
13	BOLIVAR 1

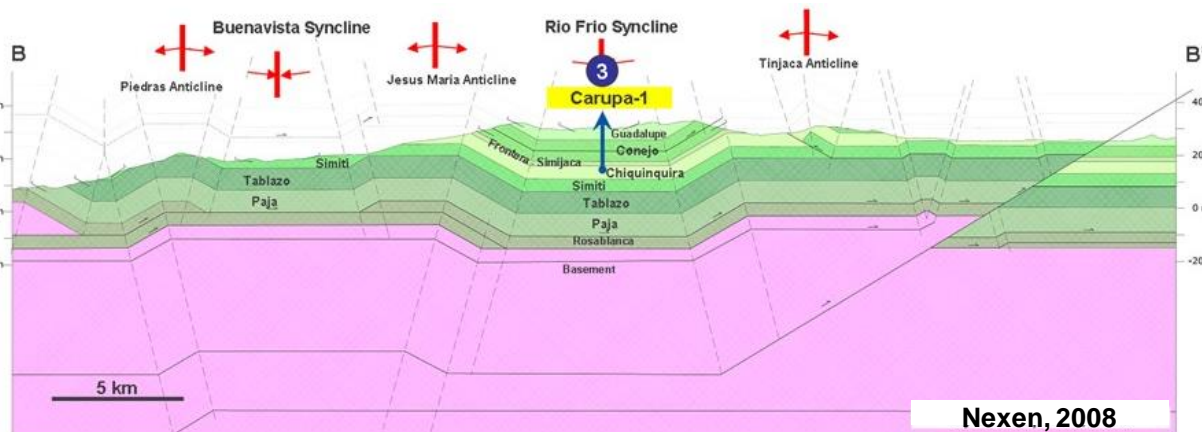
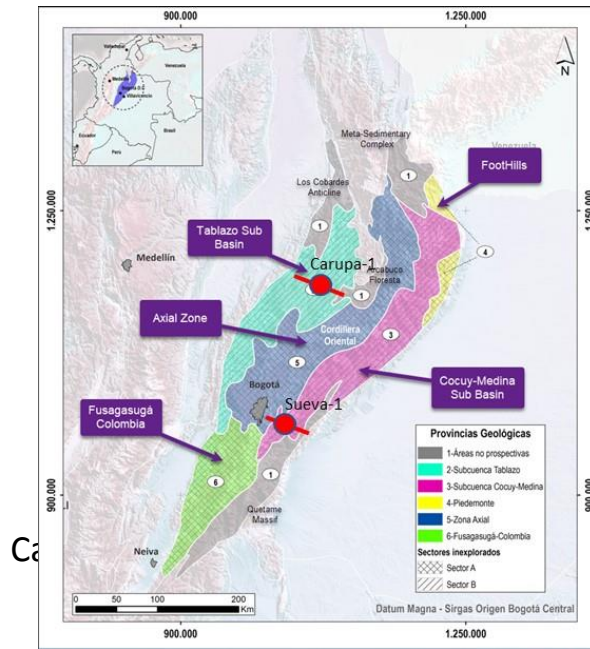


- LPG range = 1 - 41%
- Pmean = 11 %
- 82% of the analyzed wells have more than 5% LPG
- LPG Probability P50 = 8.8 %

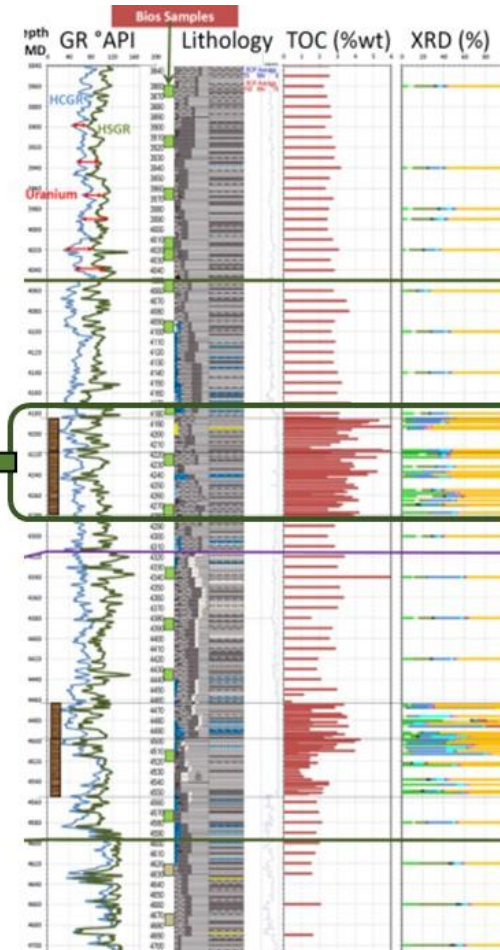


# Play Source Rocks Reservoirs (Natural Fractured Reservoirs)

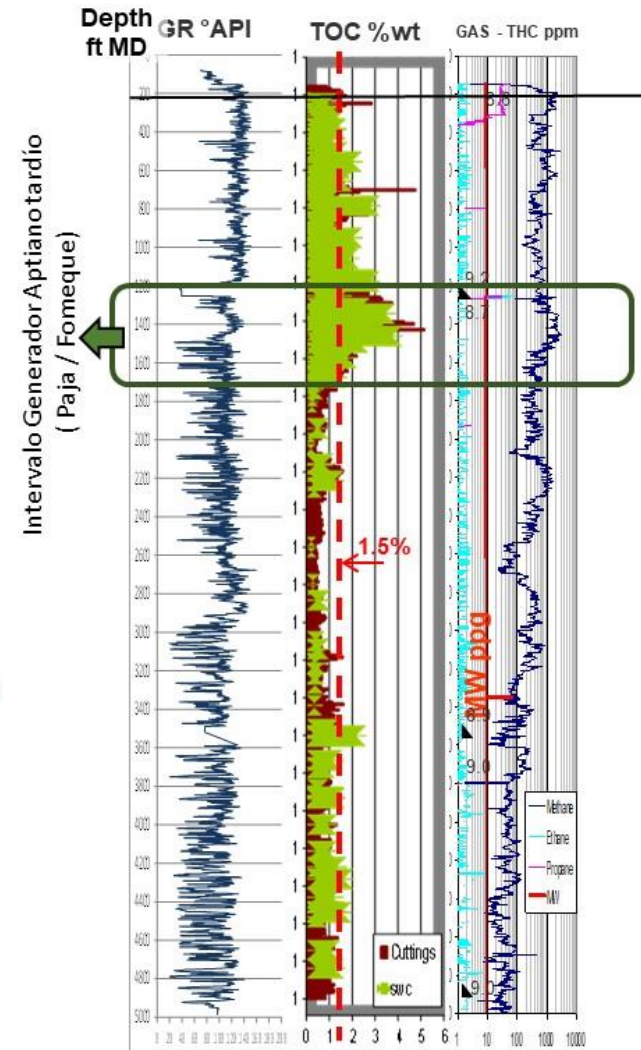
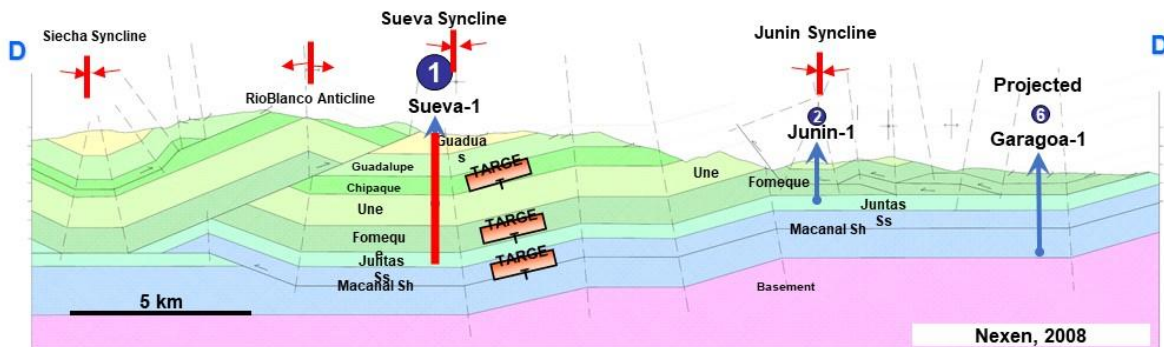
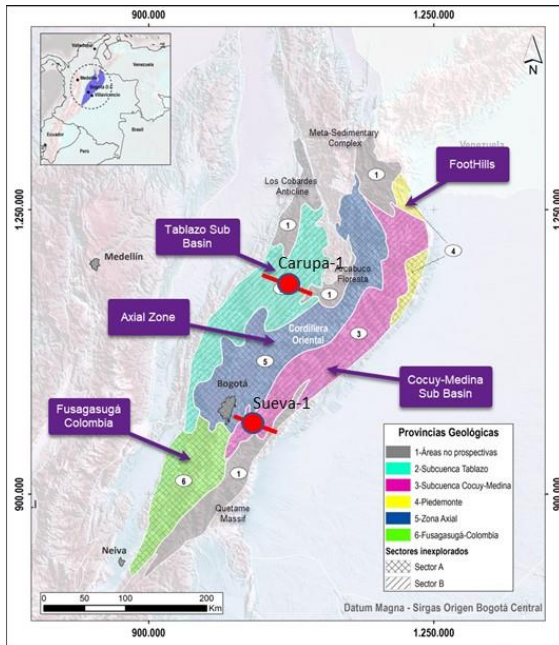




Intervalo Generador Turoniano  
( Frontera /Chipaque Inferior)



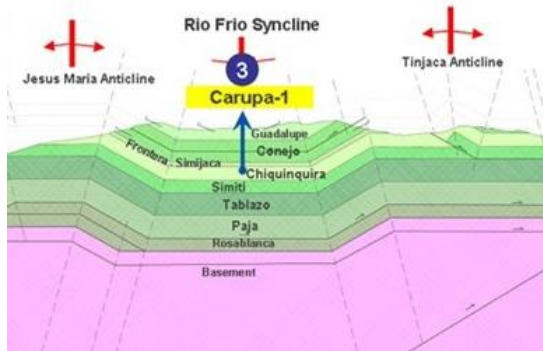
- Shales orgánicos, silíceos y calcáreos
- Espesor 270 pies
- % TOC actual variando entre 2 y 6.5%
- Kerógeno tipo II (Liptinita 70-90%)
- Alta Madurez (%Ro = 2.2)
- $\phi = 5.6\%$  / K= 100nD
- Contenido de arcilla promedio 20%



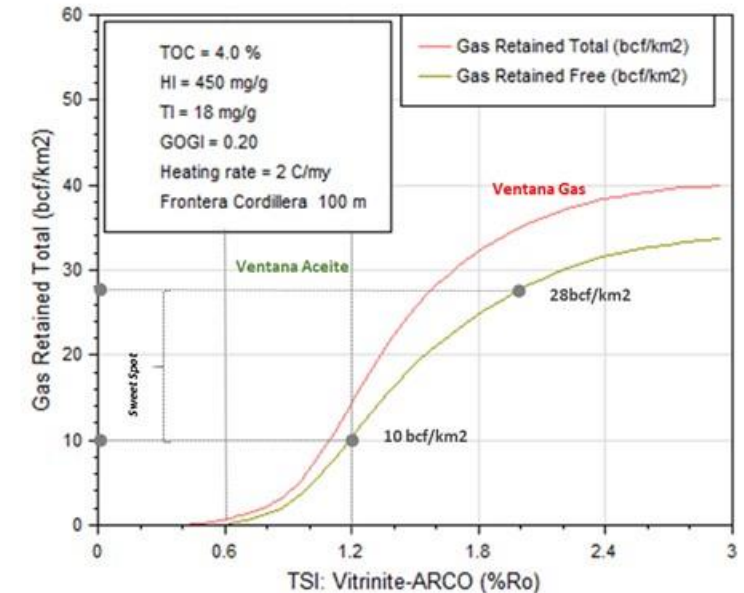
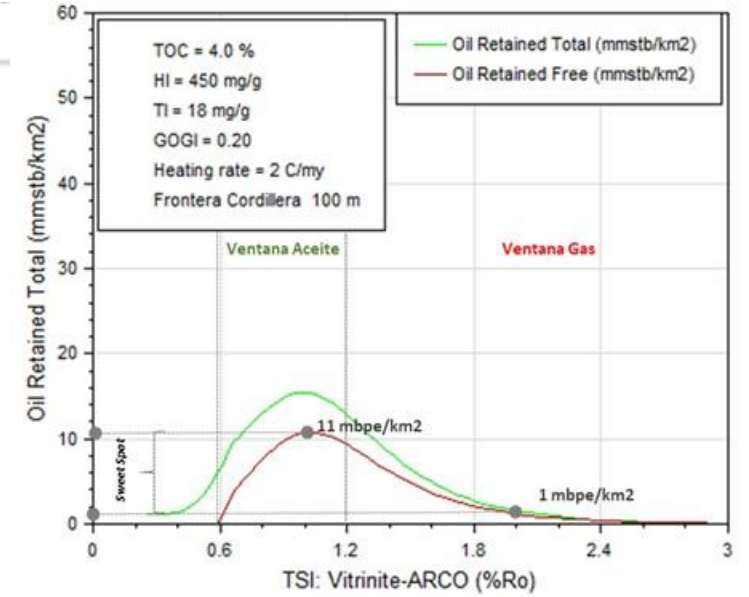
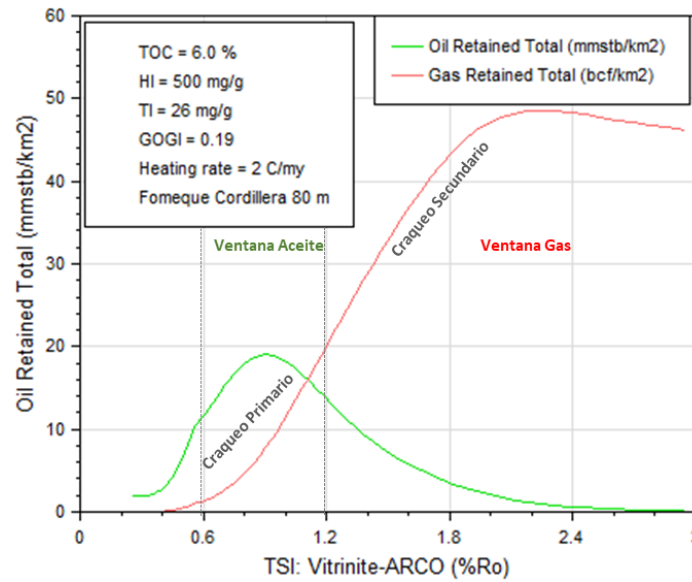
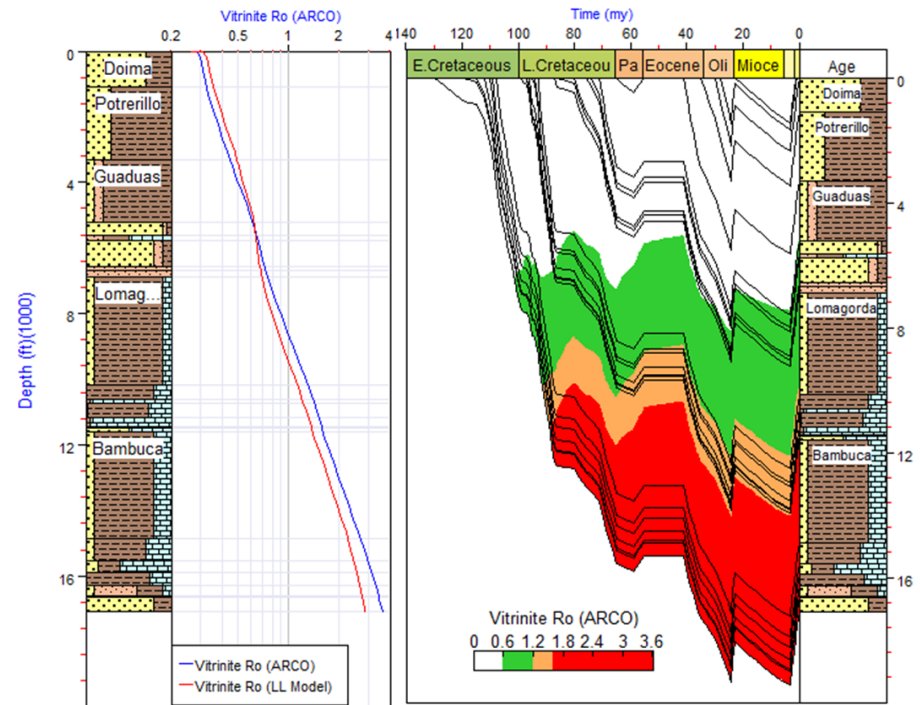
- Shales orgánicos, y calcáreos
- Espesor 650 pies
- % TOC actual variando entre 5 y 12%
- Kerógeno tipo II (Liptinita 70-90%)
- Alta Madurez (%Ro = 3.0)
- $\phi = 7\%$  /  $K = 3800$  nD
- Contenido de arcilla 40-60%



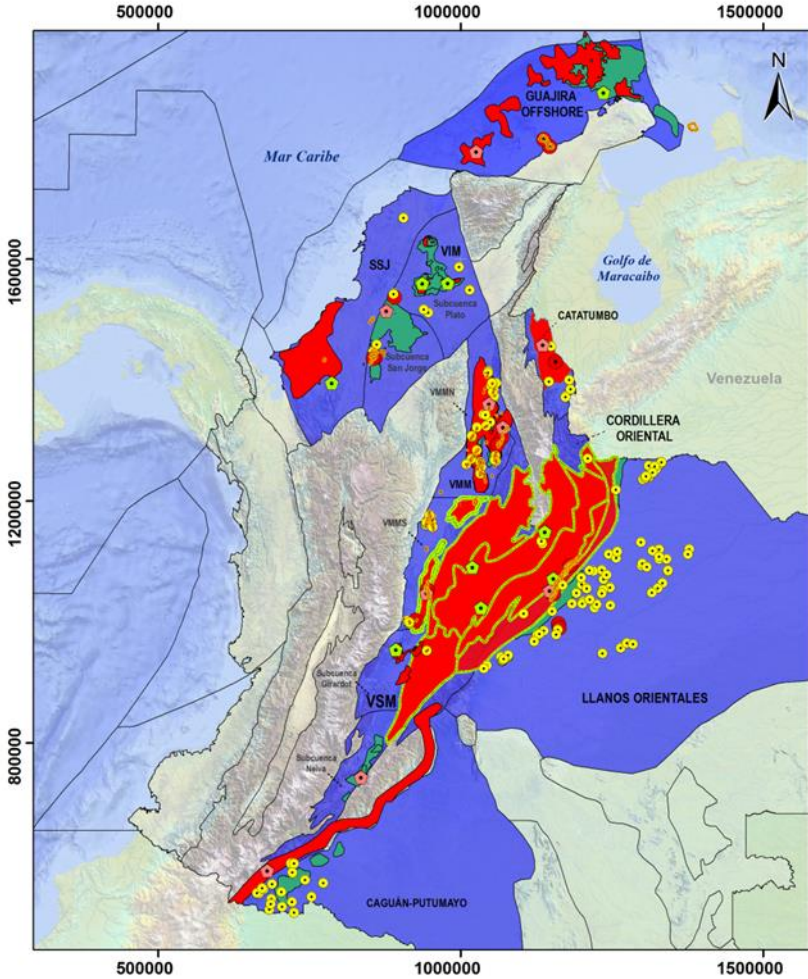
# Play Source Rocks Reservoirs (Natural Fractured Reservoirs)




Carupa-1




# Yet to Find / Convencional Gas Onshore Basins

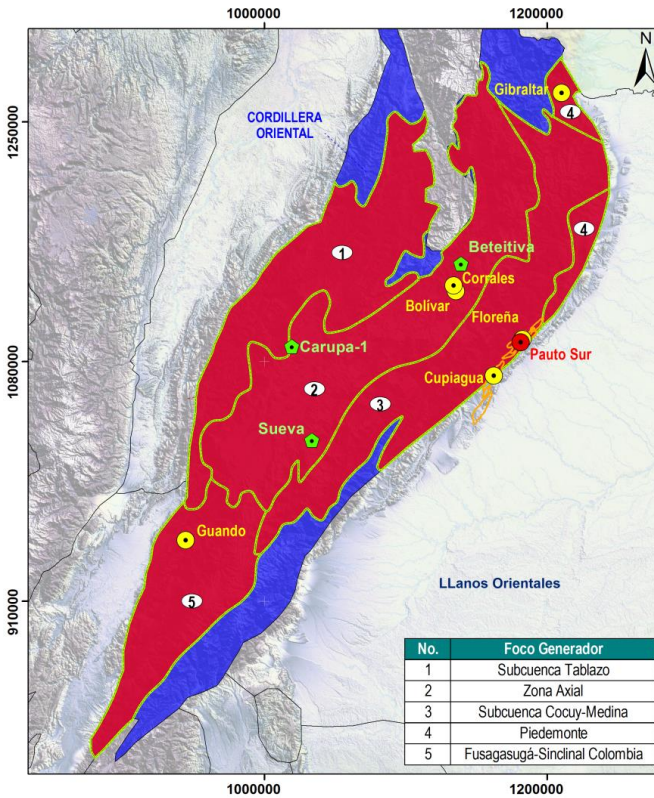


Cuenca	Gas disponible (GOES-GOR) Tpc	Probabilidad de hallazgo	Recursos prospectivos gas (GOES-GOR) Tpc	Gas descubierto Cálculo GOES 2020 Tpc	Recursos prospectivos gas por descubrir (GOES-GOR) Tpc
Caguán-Putumayo	17,58	13%	2,29	0,00	2,29
Llanos-Piedemonte-Cordillera	128,05	13%	16,65	12,60	4,05
Cordillera	48,08	13%	6,25	0,07	6,18
Catatumbo	23,37	13%	3,04	0,30	2,74
VSM	14,60	13%	1,90	0,07	1,83
VMM	81,10	15%	12,16	2,90	9,26
VIM	39,91	15%	5,99	3,57	2,42
<b>Totales</b>	<b>352,683</b>		<b>48,27</b>	<b>19,51</b>	<b>28,76</b>

  
**19.5 TCF**  
 Gas Discovered (OGIP)

  
**28.7 TCF**  
**Gas Prospective Resources**

# Yet to Find / Convencional Gas Cordillera Basin



**Convenciones**

- Ventana Gas
- Ventana Aceite
- Pozo
- Campos de Gas
- Campos de Gas Asociado
- Campos
- Cuenca

Sistema de coordenadas:  
MAGNA Colombia Bogotá  
Proyección: Transversa de Mercator  
Datum: MAGNA  
Unidades: Metros  
0 10 20 40 60 80  
Kilometros

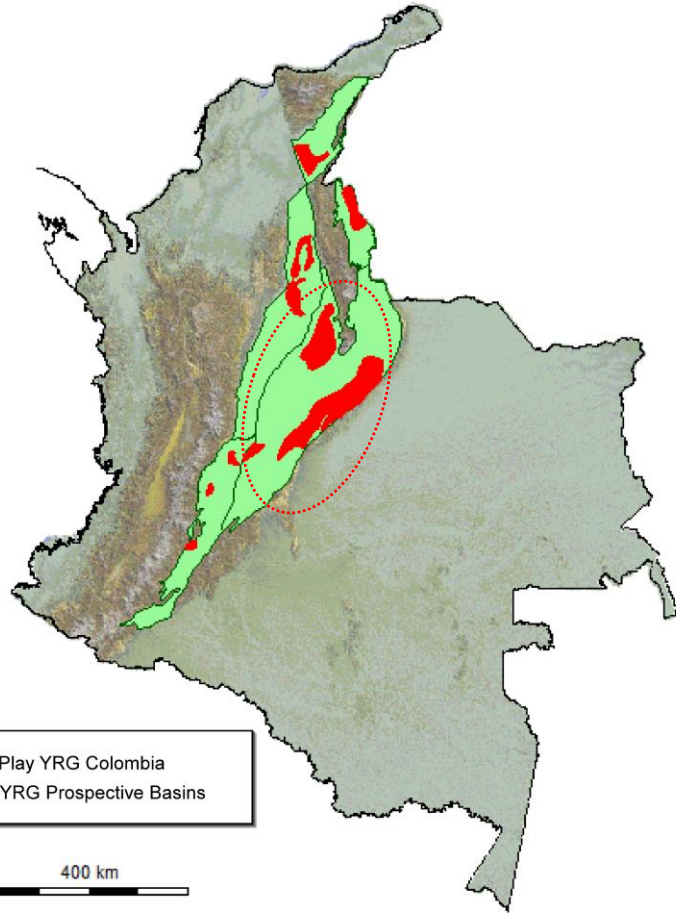
**Mapa de Distribución  
Ventanas de Aceite y Gas  
Intervalos Generadores  
Fómeque-Paja  
Cuenca Cordillera Oriental**



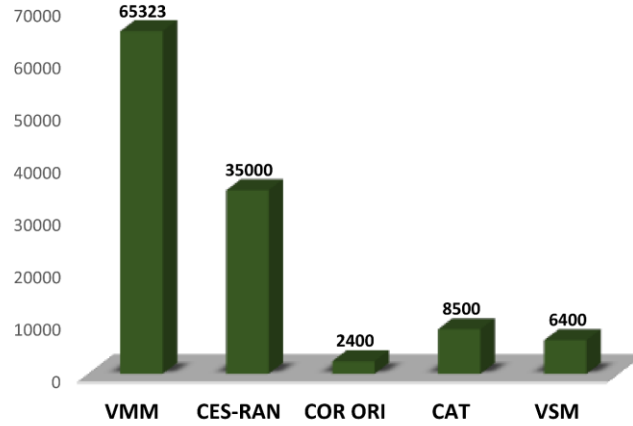
## SREPC Cuenca Cordillera

Parámetro	Unidades	Foco generador Fusagasugá-Colombia		Foco generador Tablazo		Foco generador Zona Axial		Totales	Relación Desc/Disp
		Turoniano- Santoniano	Aptiano- Albiano	Turoniano- Santoniano	Aptiano- Albiano	Turoniano- Santoniano	Aptiano- Albiano		
<b>Entrada</b>									
Área foco generador	Km2	9.200	9.200	10.200	10.200	19.000	19.000		
IH original	mg HC/g TOC	400	445	400	445	400	445		
Espesor roca generadora efectiva	Metros	82	135	82	135	82	135		
TOC original	%	3,5	4,5	3,5	4,0	3,5	4,0		
<b>Calculados</b>									
Aceite expulsado/Km2	Mmbp/km2	13,7	33,0	13,7	33,0	13,7	33,0		
Gas expulsado/Km2	Gpc/km2	39,4	85,8	39,4	85,8	39,4	85,8		
Total hidrocarburos expulsados/Km2	Mmbpe/km2	20,5	47,8	20,5	47,8	20,5	47,8		
Aceite expulsado	Mmbp	12604,0	30360,0	13974,0	33660,0	26030,0	62700,0	179328,0	
Gas expulsado	Gpc	36248,0	78936,0	40188,0	87516,0	74860,0	163020,0	480768,0	
<b>Gas expulsado</b>	<b>Tpc</b>	<b>362,5</b>	<b>789,4</b>	<b>401,9</b>	<b>875,2</b>	<b>748,6</b>	<b>1630,2</b>	<b>4807,7</b>	
Total hidrocarburos expulsados	Mmbpe	18860,0	43976,0	20910,0	48756,0	38950,0	90820,0	262272,0	
Factor pérdida migración	%	99%	99%	99%	99%	99%	99%		
Aceite disponible	Mmbp	1260	3036	1397	3366	2603	6270	17932,8	
<b>Gas disponible</b>	<b>Tpc</b>	<b>3,6</b>	<b>7,9</b>	<b>4,0</b>	<b>8,8</b>	<b>7,5</b>	<b>16,3</b>	<b>48,1</b>	
Total hidrocarburos disponibles	Mmbpe	1886,0	4397,6	2091,0	4875,6	3895,0	9082,0	26227,2	
Probabilidad de hallazgo	%	13%	13%	13%	13%	13%	13%		
Recursos prospectivos aceite	Mmbp	163,9	394,7	181,7	437,6	338,4	815,1	2331	
<b>Recursos prospectivos gas</b>	<b>Tpc</b>	<b>0,5</b>	<b>1,0</b>	<b>0,5</b>	<b>1,1</b>	<b>1,0</b>	<b>2,1</b>	<b>6,2</b>	
Recursos prospectivos hidrocarburos	Mmbpe	245,2	571,7	271,8	633,8	506,4	1180,7	3410	
<b>Gas descubierto - Cálculo GOES 2020</b>	<b>Tpc</b>							<b>0,1</b>	<b>0,1%</b>
<b>Recursos prospectivos gas por descubrir</b>	<b>Tpc</b>							<b>6,2</b>	<b>12,9%</b>

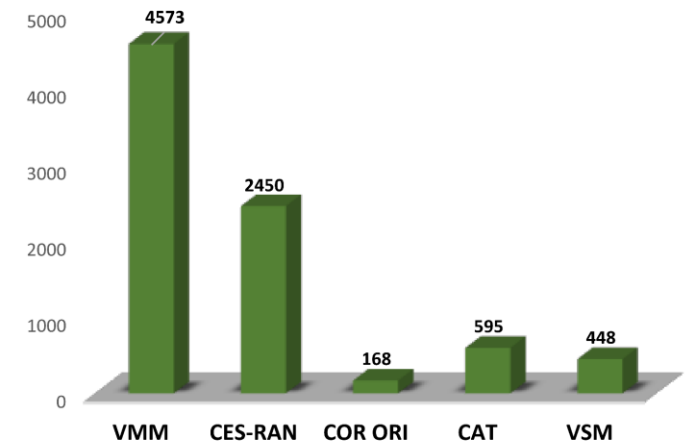
# Yet to Find / Source Rocks Reservoirs Gas Onshore Basins



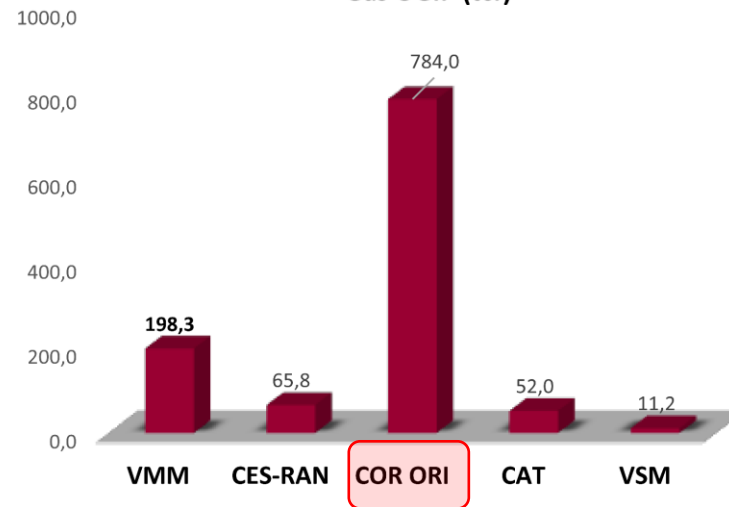
Prospective Resources  
Oil OOIP (mbp)



Recoverable Prospective Resources  
Oil (mbp)



Prospective Resources  
Gas OGIP (tcf)



Recoverable Prospective Resources  
Gas (tcf)

