

Ronda Colombia 2012



Technical aspects of the Colombia 2012 Round

Content



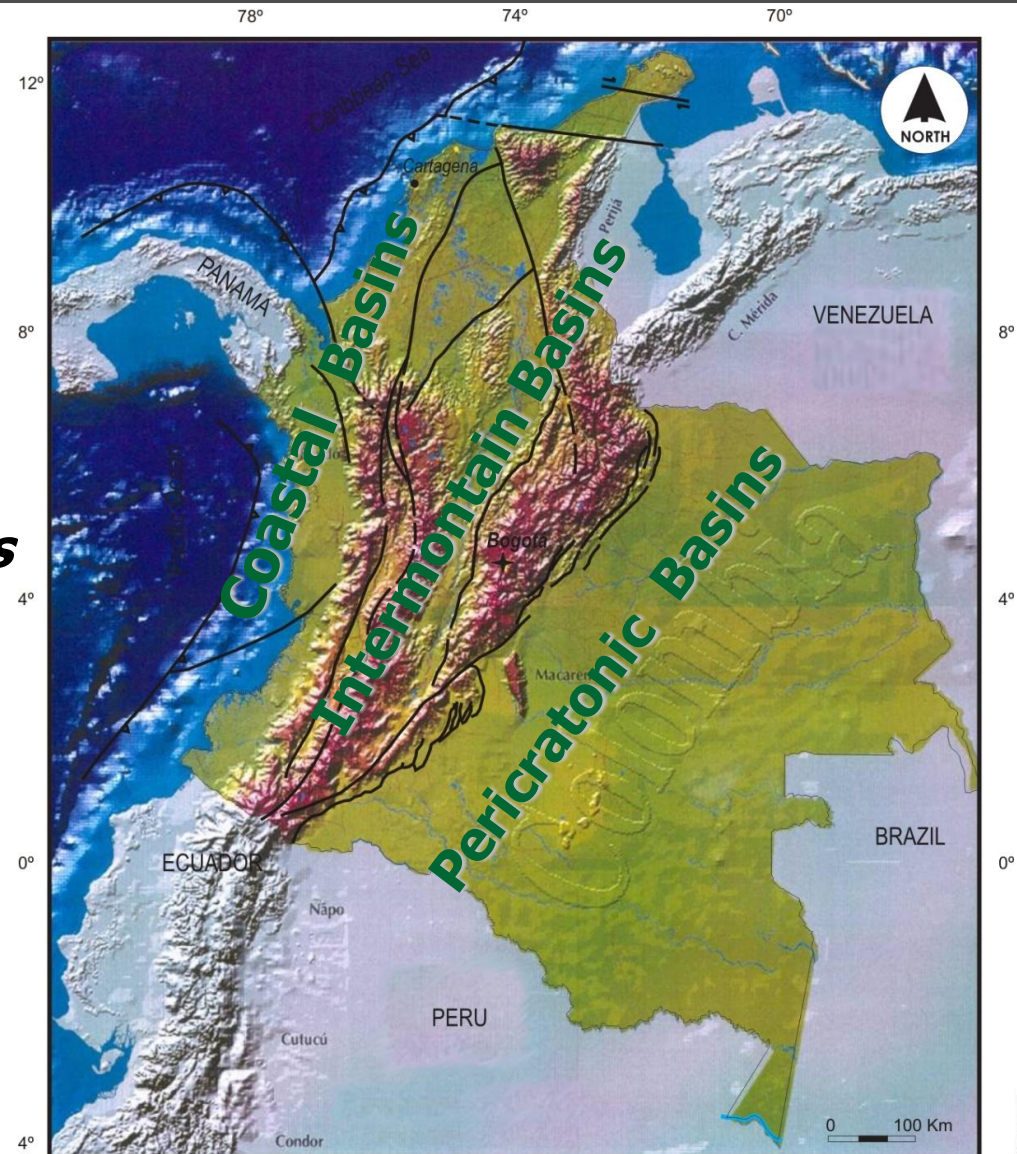
1. Introduction
2. Colombian Round 2012
3. Technical aspects of Main Basins
4. Unconventional resources
5. Database
6. Summary and Conclusions

Introduction

Colombia

= *Country with
Diverse
Geology*

= *Very different types
of Basins*



Introduction



Texas is about
60% of the size of
Colombia

Colombia

1,141,748 Km²

Texas

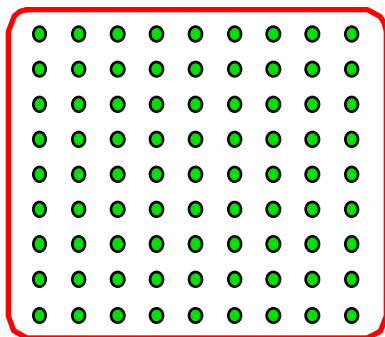
696,241 Km²

Colombia - An underexplored country

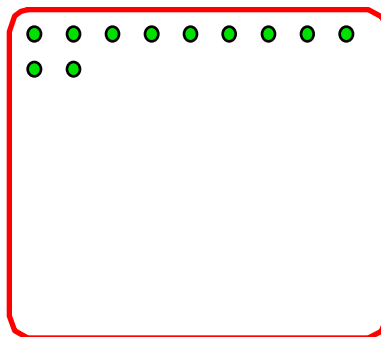
Wells per 1.000 Km²

UNITED STATES	—————→	83
CANADA	—————→	11
COLOMBIA	—————→	2

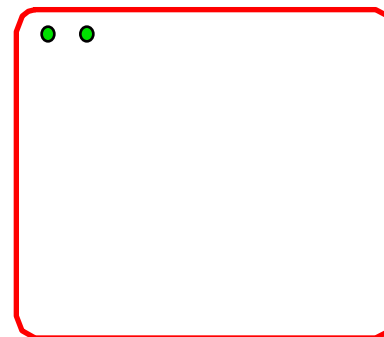
UNITED STATES



CANADA



COLOMBIA



Western Sedimentary Basin of Canada

Approx. 525,000 wells
1 well / 2.5 km²

Eastern Cordillera-Llanos-Putumayo
2,026 wells
1 well / 200 km²

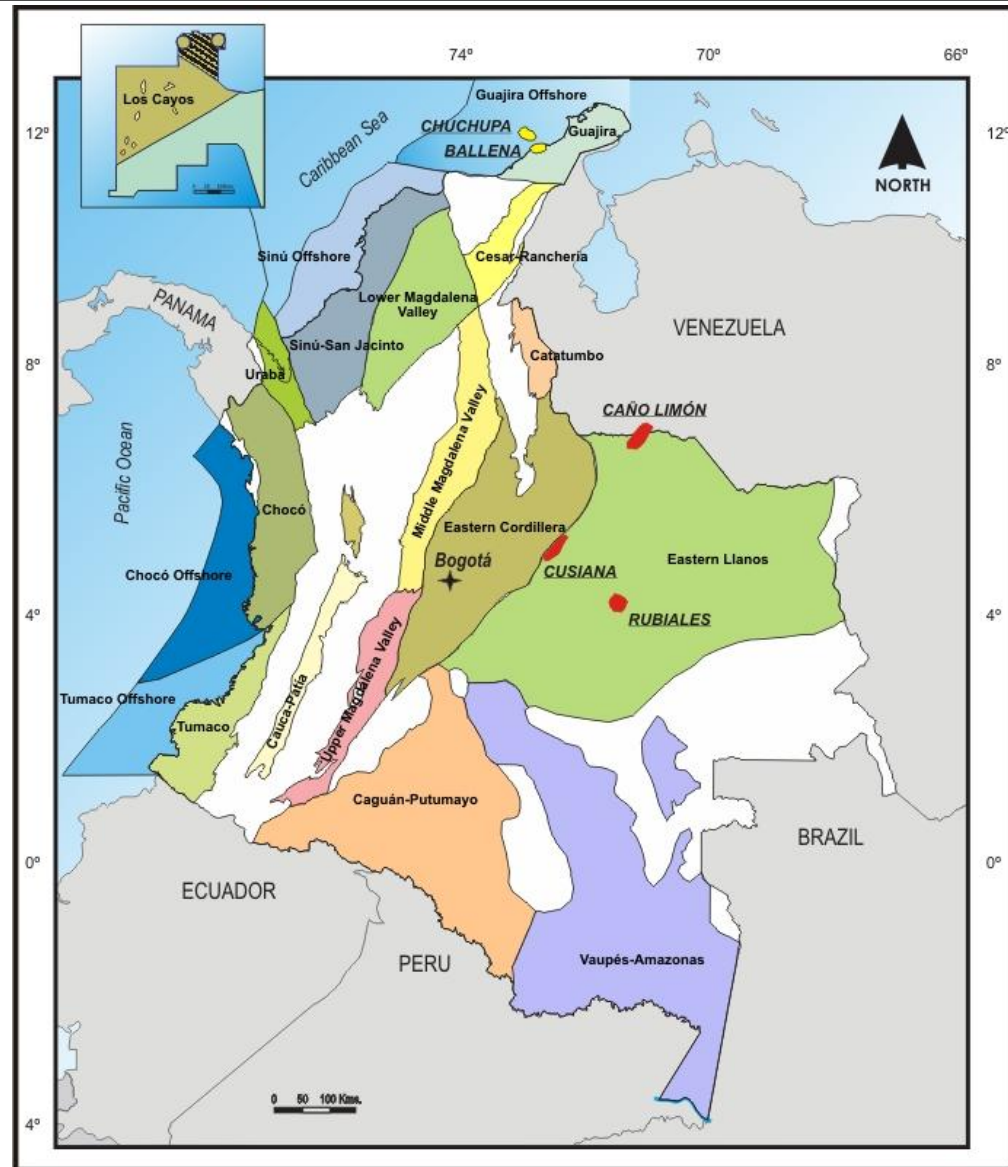
Colombia still has a lot of room to explore!

Colombian Basins

Colombia has a large number of proven and high potential oil and gas basins:

Mature and emerging pericratonic and intramontane basins in the eastern and central parts of Colombia.

Emerging and frontier coastal and offshore basins in the western and northern parts of Colombia.

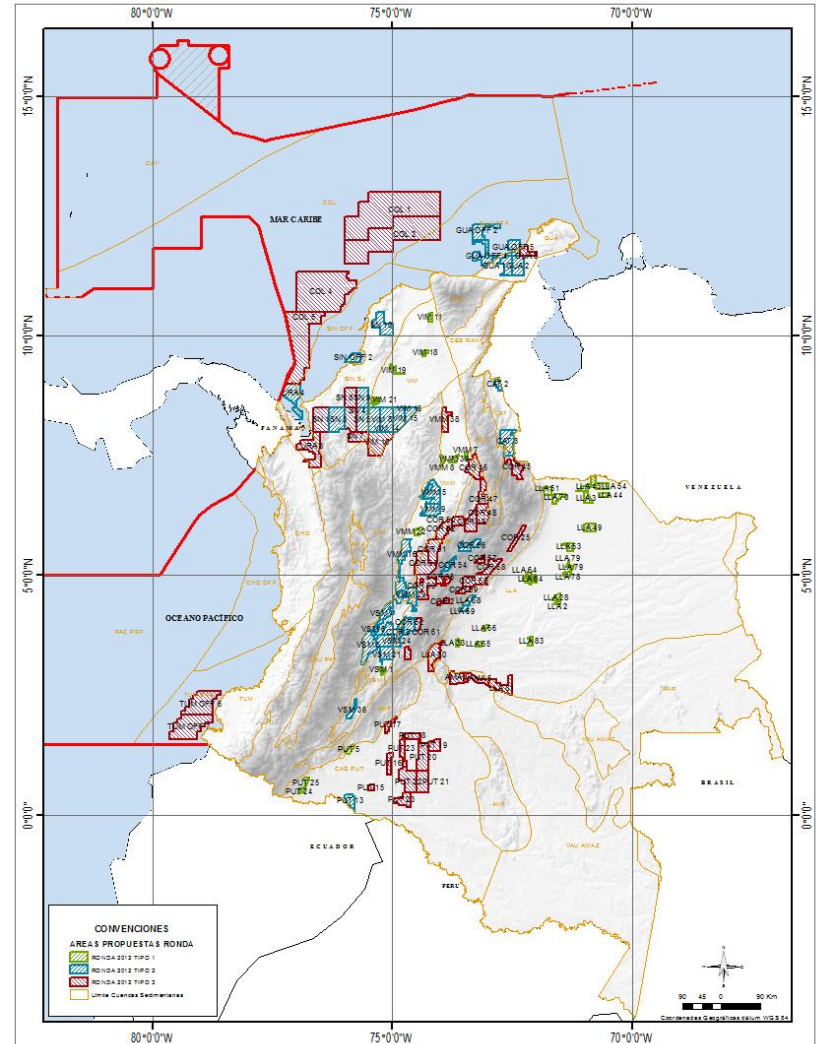
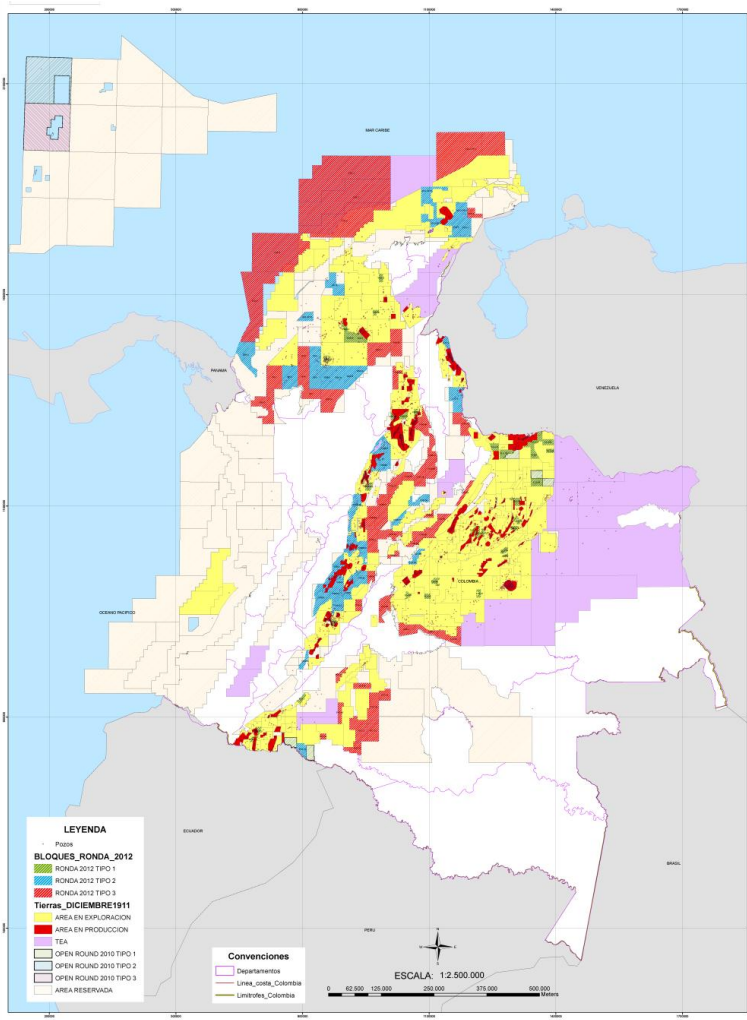


Content



1. Introduction
2. Colombian Round 2012
3. Technical aspects of Main Basins
4. Unconventional resources
5. Database
6. Summary and Conclusions

2. Colombian Round 2012



Áreas ofrecidas

On Shore Off Shore

Tipo 1	29	
Tipo 2	29	5
Tipo 3	40	6
Total	98	11

BASIN	TYPE 1	TYPE 2	TYPE 3	TOTAL
VAU AMAZ			2	2
CAT		2		2
COL			4	4
COR		4	19	23
GUA		2	1	3
GUA OFF		3		3
LLA	17	2	2	21
CAG PUT	3	1	9	13
SIN OFF		1		1
SIN SJ		4	4	8
TUM OFF			2	2
URA		1	1	2
VIM	4	4	1	9
VMM	4	4	1	9
VSM	1	6		7
Total	29	34	46	109

Tipo	Sísmica 2D (km)	Número de pozos	Total (Has)
Tipo 1	914	76	656.520
Tipo 2	1.644	186	3.591.333
Tipo 3	438	23	9.229.703
Total	2.996	285	13.477.556

Package Information

BLOCKS	2D PROGRAMS	2D LINES	3D PROGRAMS 3D	WELLS
ANP	4	5	0	0
CAG-PUT	27	131	1	11
CAT	13	106	0	13
COL	1	10	0	0
COR	41	201	0	8
GUA	21	187	0	6
GUA OFF	3	5	0	2
LLA	136	648	10	31
PAC-OFF	2	72	0	4
SIN OFF	4	38	0	0
SIN SJ	23	135	0	25
URA	8	126	0	4
VIM	33	170	4	36
VMM	94	561	2	79
VSM	94	601	3	66
TOTAL	504	2996	20	285

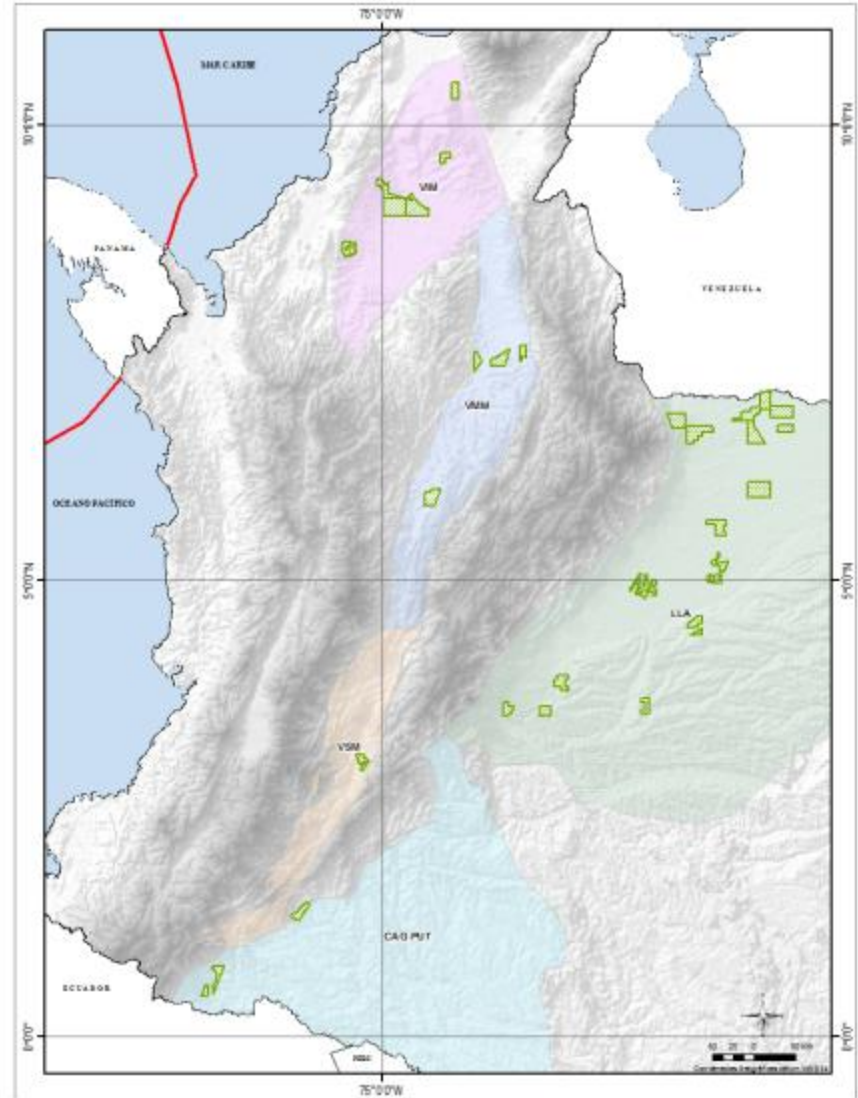
Type 1 Blocks

Blocks in mature areas. E&P contracts will be subscribed

Type 1	
BLOCK	AREA (Ha)
29	656.520

Seismic lines	Wells
Number of Lines	Number of wells
914	76

Basins
<ul style="list-style-type: none"> • Lower Magdalena Valley • Middle Magdalena Valley • Upper Magdalena Valley • Caguán-Putumayo • Llanos



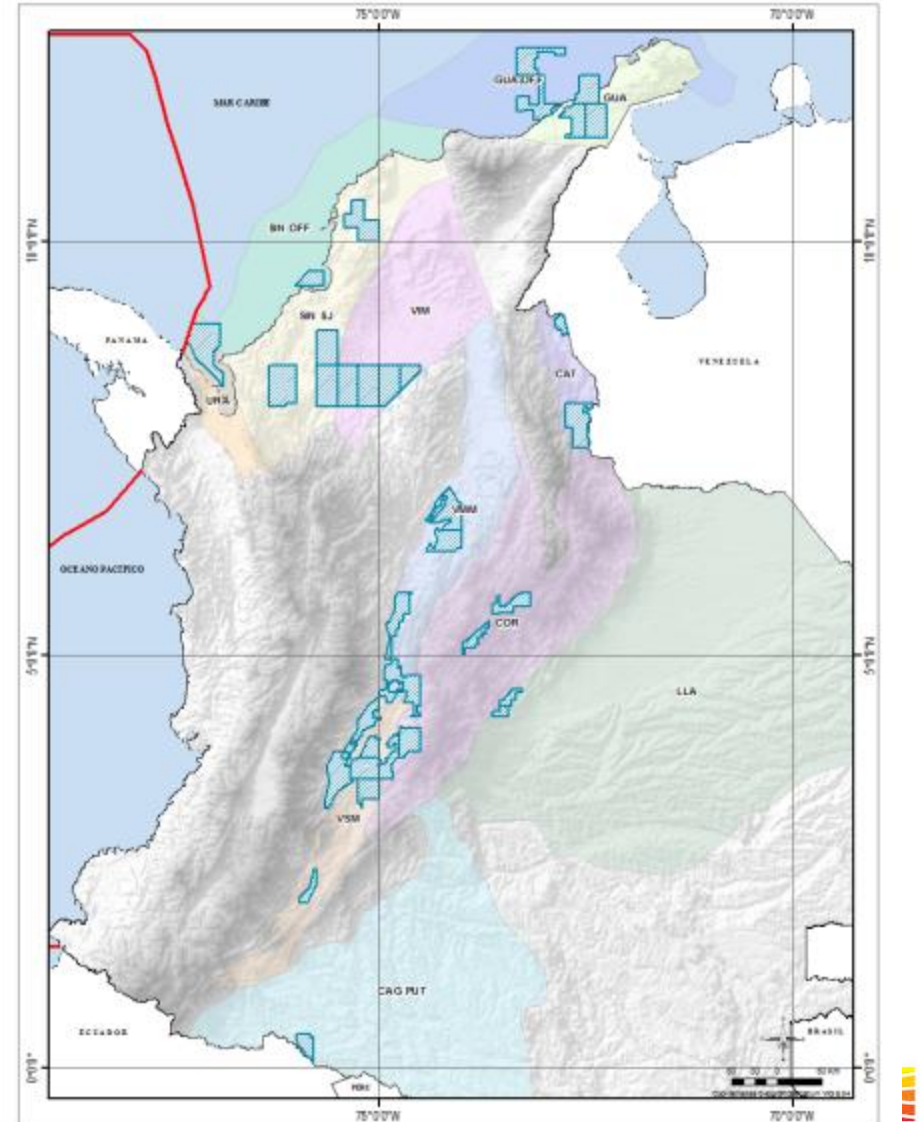
Type 2 Blocks

Blocks with new prospectivity. E&P contracts will be subscribed

Type 2	
BLOCKS	AREA (Ha)
34	3.591.333

Seismic Lines	Wells
Number of Lines	Number
1.644	186

Basins	
<ul style="list-style-type: none"> •Guajira •Guajira Offshore •Sinú Offshore •Uraba •Sinú-San Jacinto •Valle Inferior del Magdalena 	<ul style="list-style-type: none"> •Valle Medio del Magdalena •Valle Superior del Magdalena •Caguán-Putumayo •Llanos •Cordillera •Catatumbo



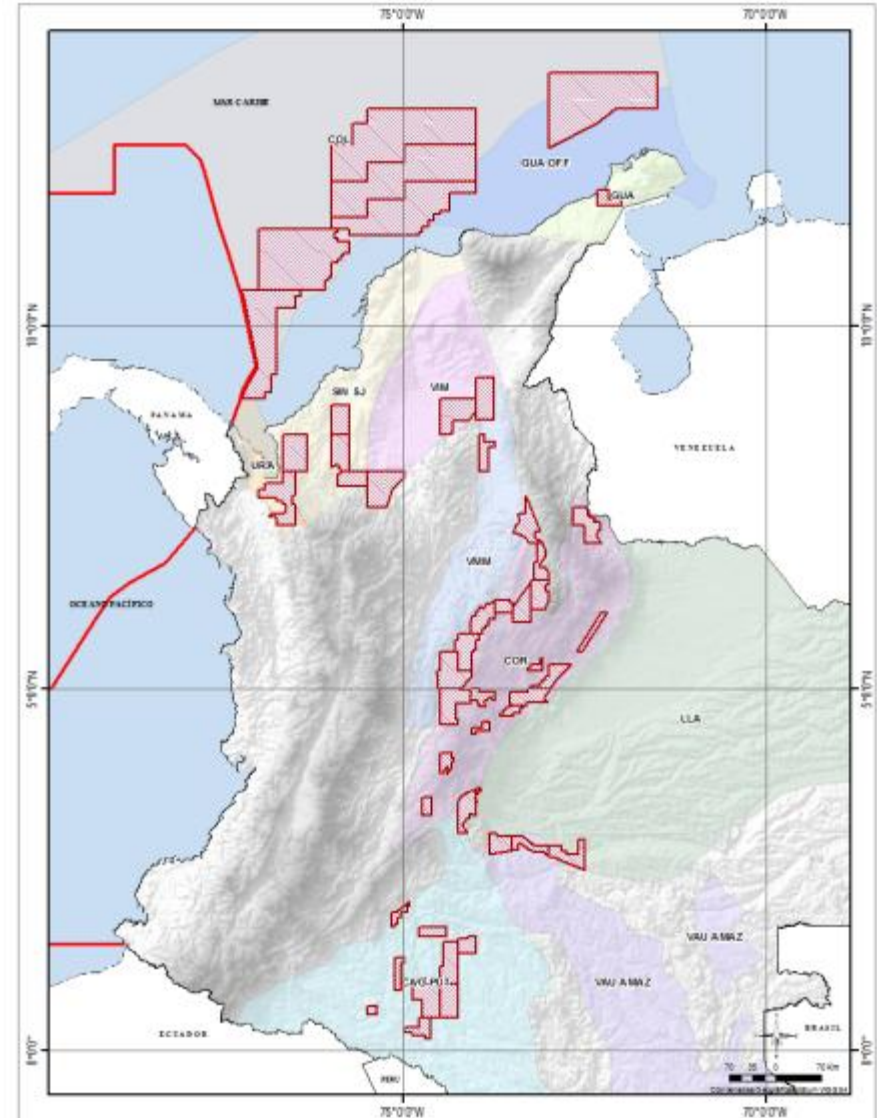
Type 3 Blocks

Exploration Blocks in frontier areas for Technical Evaluation Agreements (TEA)

Type 3	
BLOCKS	AREA (Ha)
46	9.229.703

Seismic Lines	Wells
Number of lines	Number of wells
438	23

Basins	
<ul style="list-style-type: none"> • Guajira • Guajira Offshore • Colombia • Uraba • Sinú-San Jacinto • Lower Magdalena Valley 	<ul style="list-style-type: none"> • Vaupés-Amazonas • Middle Magdalena Valley • Caguán-Putumayo • Llanos • Cordillera



Minimum Exploration Program – Blocks Type 1 & 2 Conventional Onshore



Phase I (3 years)	Phase II (3 years)
2D Seismic, minimum 1km/5km ²	3D Seismic, mínimo 1km ² /10km ²
1 Exploratory well	2 Exploratory wells

Minimum Exploration Program Type 2 Conventional offshore



Type 2	
Basins	Activities
Offshore	<p>Phase I (36 months)</p> <ul style="list-style-type: none"> ✓ 15 km2 of 3D seismic / 20.000 Ha ✓ Collection of one (1) piston core / 20.000 Ha. <p>Phase II (36 months)</p> <ul style="list-style-type: none"> ✓ Drilling of one (1) well

Minimum Exploration Program – Blocks Type 2 Unconventional



Phase I (3 años)	Phase II (3 años)	Phase III (evaluation) (2 años)
Cartografía geológica de superficie a escala 1:25.000 o mayor, de mínimo el 50% del área del bloque.		
Geoquímica de superficie mínimo 1 km/5 km ² del área del bloque.		
Sísmica 2D de mínimo 1km/5km ²		
2 pozos estratigráficos, con registros físicos y geoquímicos	1 pozo estratigráfico con registros físicos y geoquímicos	
	2 pozos exploratorios con registros físicos y geoquímicos	4 pozos exploratorios con registros físicos y geoquímicos.

Minimum Exploration Program – Blocks Type 3

Convencionales Fase única (3 años)	No Convencionales Fase única (3 años)	Offshore Fase única (3 años)
	Cartografía geológica de superficie a escala 1:25.000 o mayor, cobertura 50% del área.	Un ensayo de Piston Core por cada 10 km ² ha
Sísmica 2D de mínimo 1 km/10 km ²	Sísmica 2D de mínimo 1 km/10 km ²	Sísmica 2D de mínimo 1 km/10 km ²
Método de análisis regional para el área.	Método de análisis regional para el área.	Método de análisis regional para el área.
1 pozo estratigráfico	2 pozos estratigráficos, con registros físicos y geoquímicos	
	Geoquímica de superficie cubriendo mínimo 2 km/10 km ² del área del bloque.	20 km de batimetría/ 10 km ²

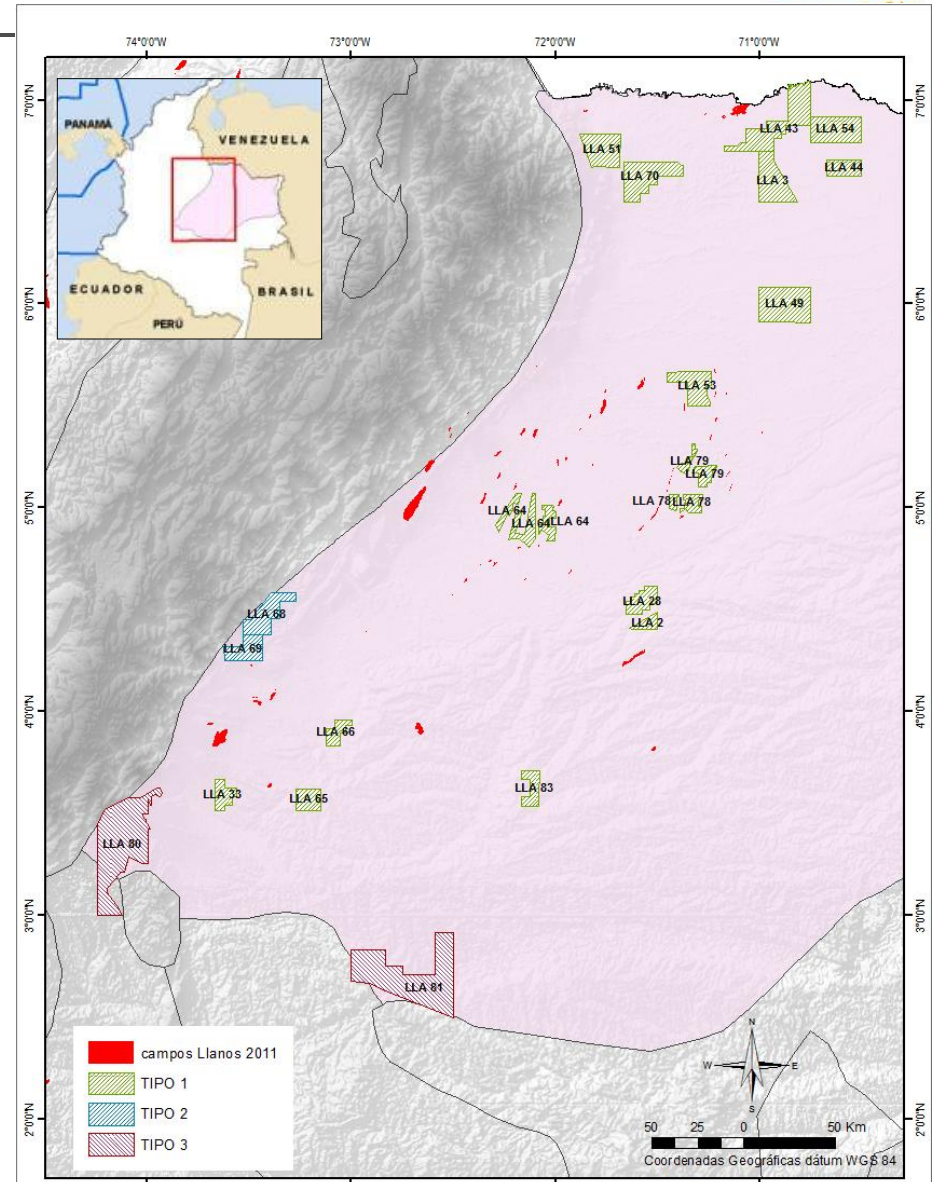
Content



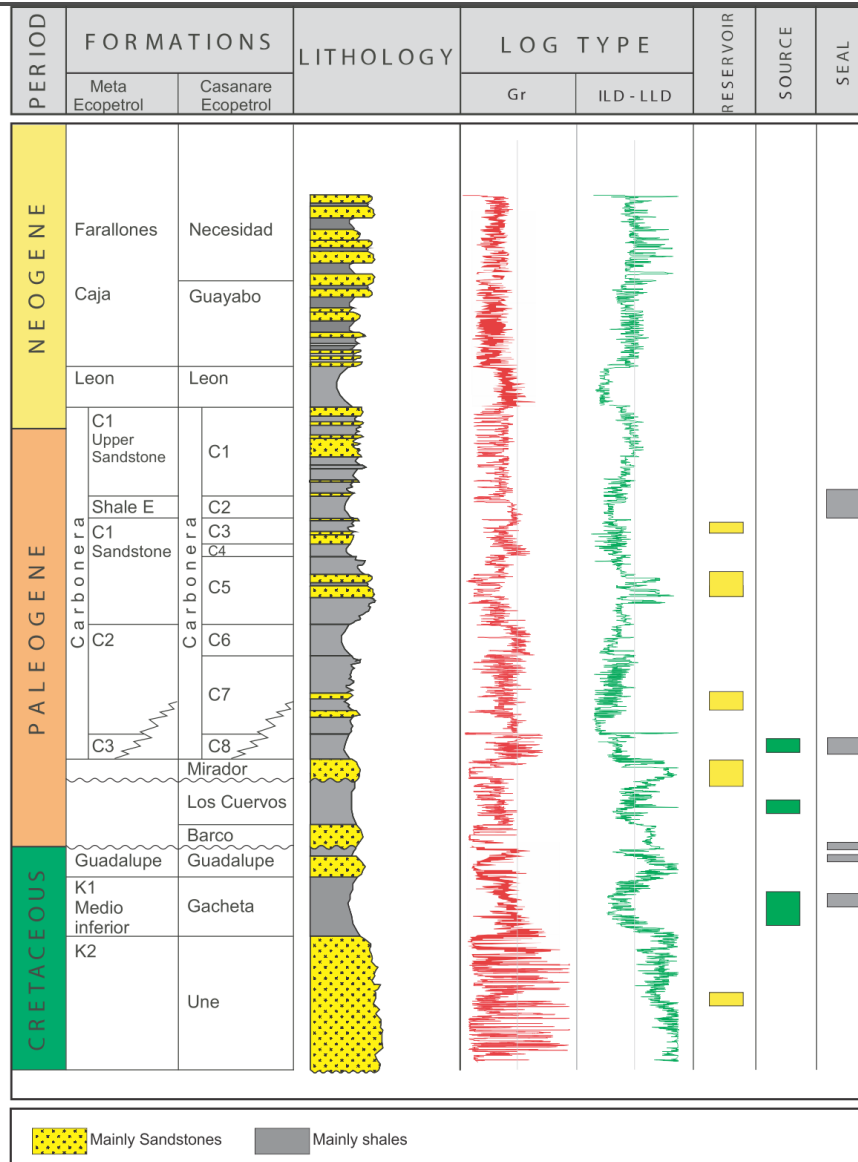
1. Introduction
2. Colombian Round 2012
3. Technical aspects of Main Basins
4. Unconventional resources
5. Database
6. Summary and Conclusions

Llanos Basin

- Relatively mature basin
- Colombia's most prolific basin.
- Potential ranges between 4,585 MMBO and 41,269 MMBO.
- A preliminary assessment suggests that the basin is also prospective for *Shale Oil* and *Shale Gas*.

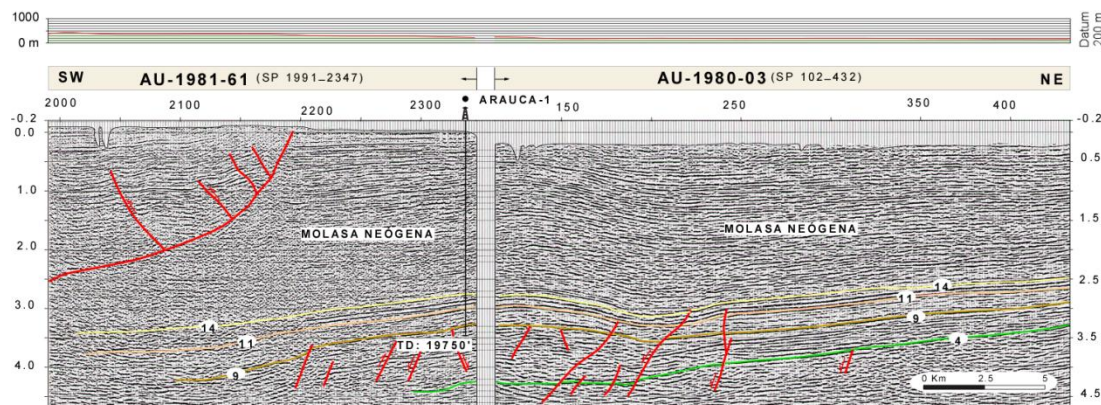
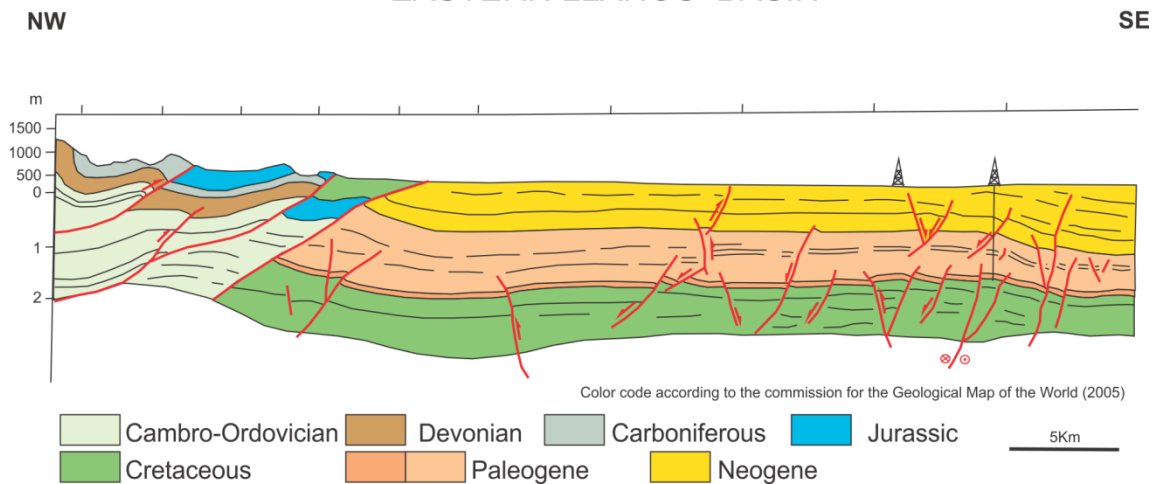


Llanos Basin



Llanos Basin

SCHEMATIC CROSS SECTION EASTERN LLANOS BASIN



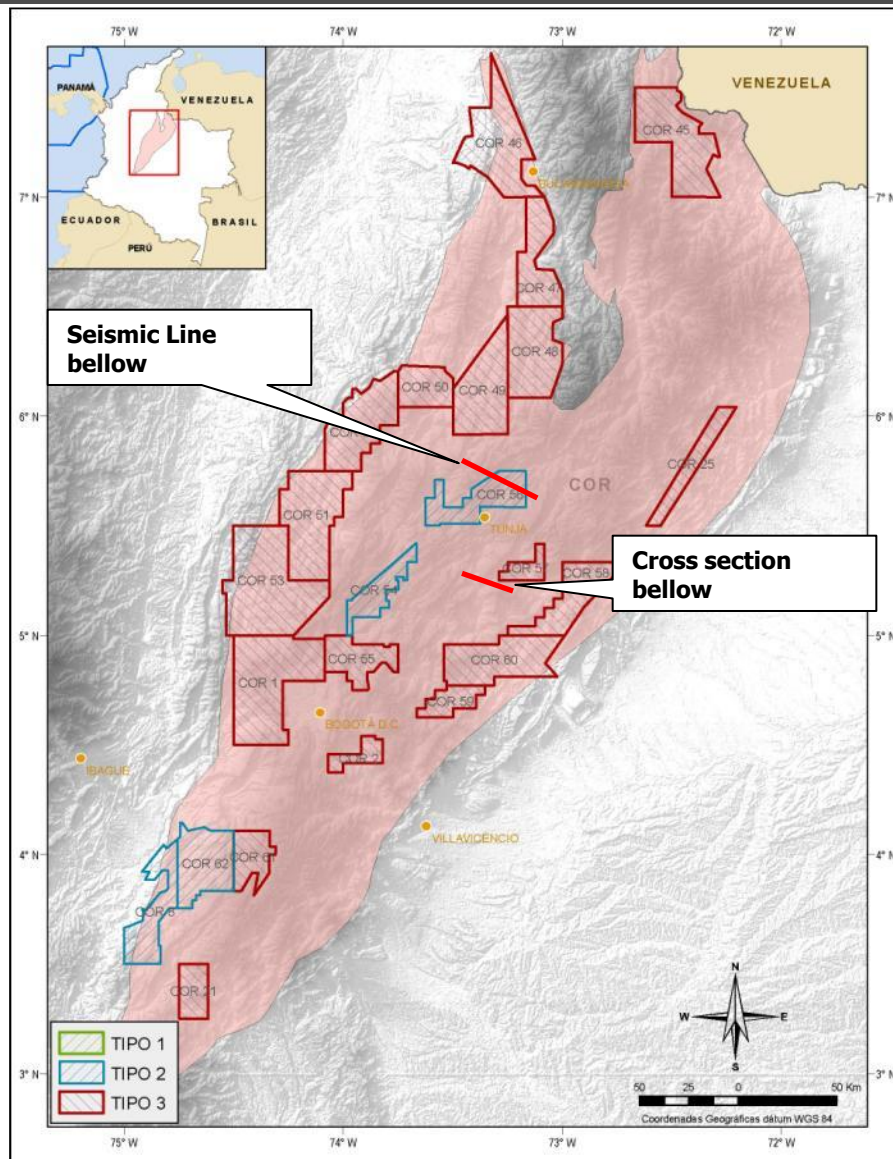
Reflectores Interpretados	
10	Disc. sub-Oligoceno
14	Disc. sub-Mioceno Sup.
11	Disc. sub-Mioceno Inf.
9	Disc. sub-Eoceno
4	Disc. sub-Cretácica
Fallamiento/ Cabalgamiento	

Geotec, Robertson Research, Ecopetrol 1998

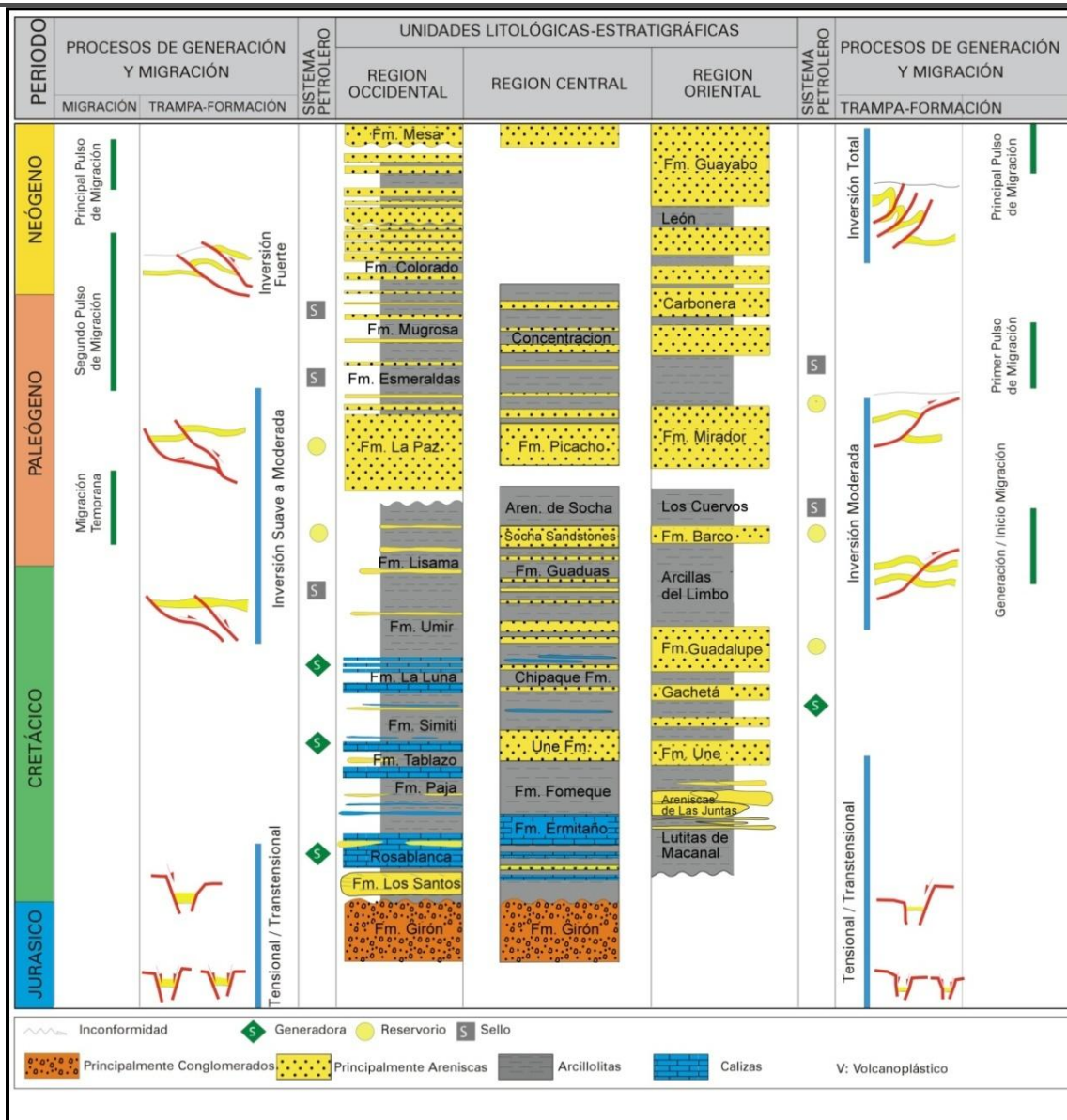
Dominios del Piedemonte

Eastern Cordillera Basin

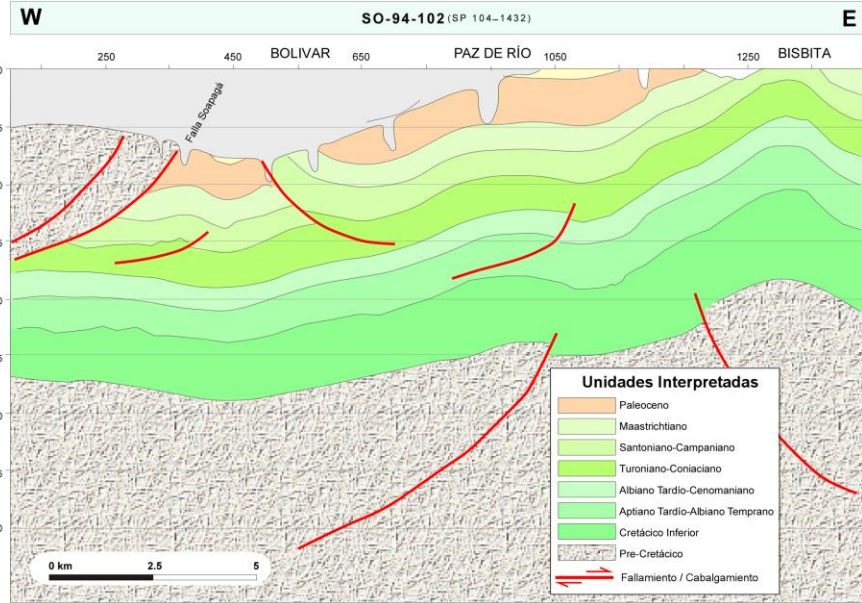
- **Active petroleum system (Numerous seeps of liquid hydrocarbons)**
- **Excellent quality source rocks (Chipaque Fm= La Luna Fm)**
- **Potential ranges between 532 MMBO and 2,600 MMBO.**
- **A preliminary assessment suggests that the basin is also prospective for *Shale Oil* and *Shale Gas*.**



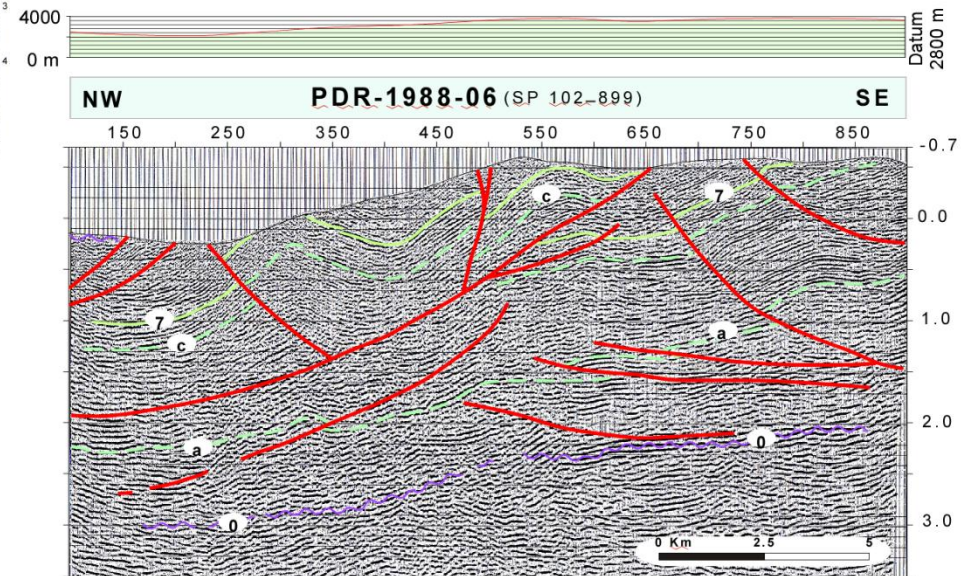
Eastern Cordillera Basin



Eastern Cordillera Basin

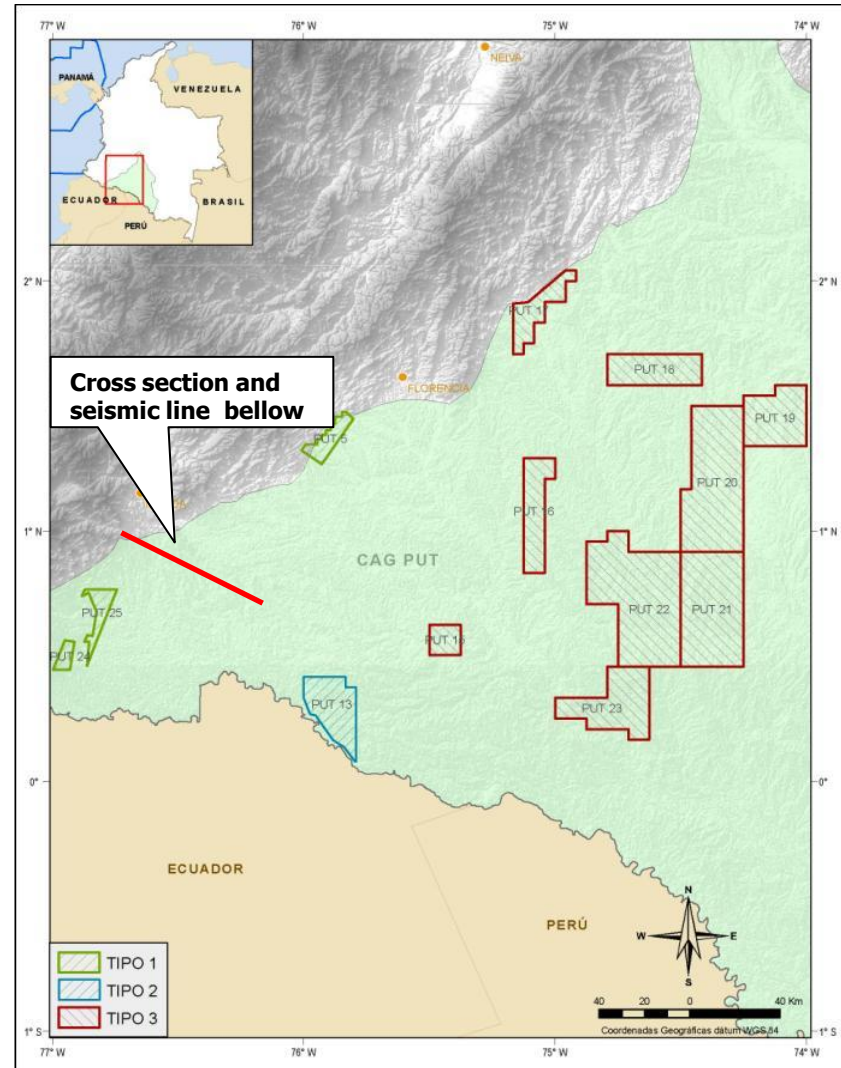


DOMINIOS DE LA DEPRESIÓN CENTRAL



Caguán – Putumayo Basin

- Possible extension of the heavy oil belt defined in the Llanos basin .
- Potential petroleum system associated with Paleozoic rocks (Caguán Sub-basin).
- Excellent quality source rocks (Villeta Fm and Caballos Fm).
- A preliminary assessment suggests that the blocks in the basin are not prospectives for *Shale Oil* and *Shale Gas*.

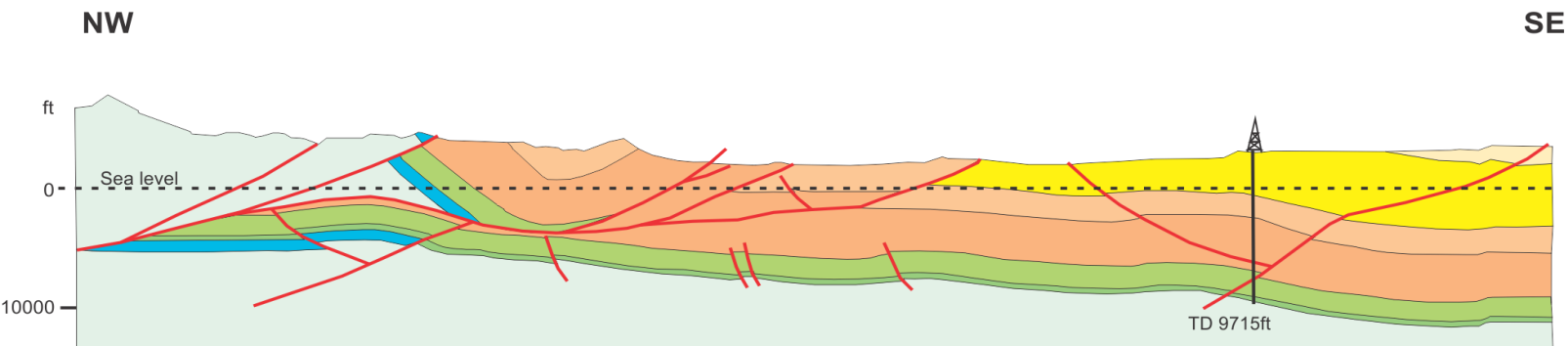


Caguán – Putumayo Basin

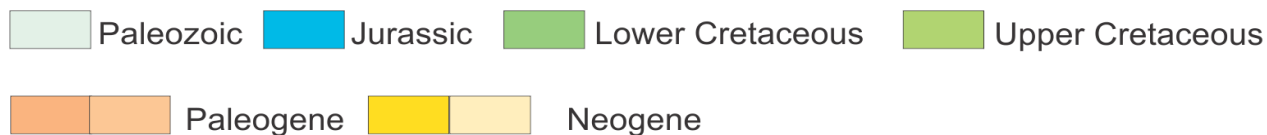
PERIOD	STRATIGRAPHIC UNIT	LITHOLOGY	ROCK			REMARKS
			R	SL	SR	
QUATERNARY						
NEOGENE	CAIMAN Fm.					Continental shales
	OSPINA Fm.					
	ORITO BELEN Gr.					
PALEOGENE	ORTEGUAZA Fm.					Sandstones and Conglomerates
	PEPINO Fm.					
	RUMIYACO Fm.					
CRETACEOUS	VILLETA Fm.	Int. N				Marine shales
		Int. M2				
		Int. A				
		Int. U				
		Int. B				
		Int. T				
		Int. C				
	Caballos Fm.					Sandstones
JURASSIC	Saldaña Fm.					non explored potential target
TRIASSIC	Payande Fm.					
PRECAMBRIC	Basement					
			R= RESERVOIR	SL= SEAL	SR= SOURCE	

Caguán – Putumayo Basin

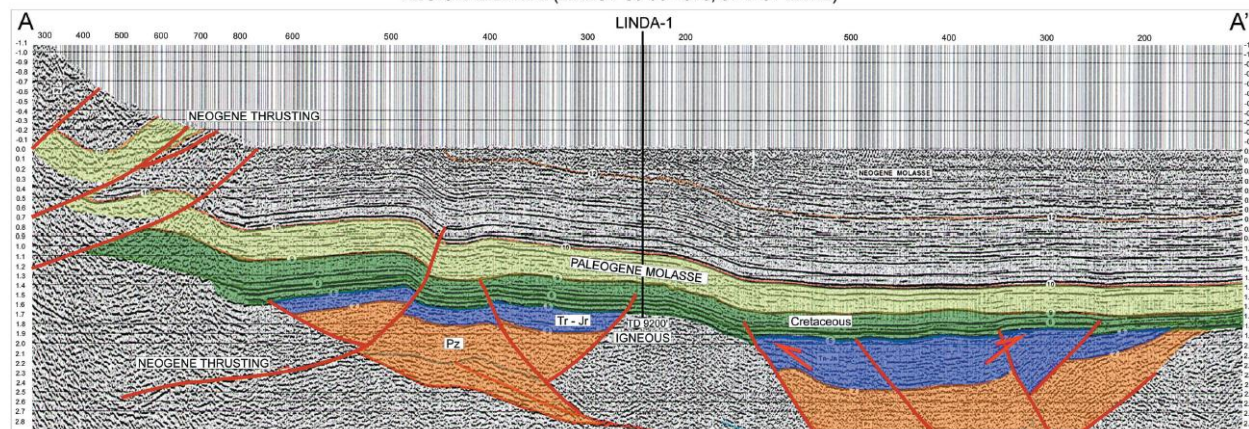
SCHEMATIC CROSS SECTION PUTUMAYO BASIN



Color code according to the commission for the Geological Map of the World (2005)

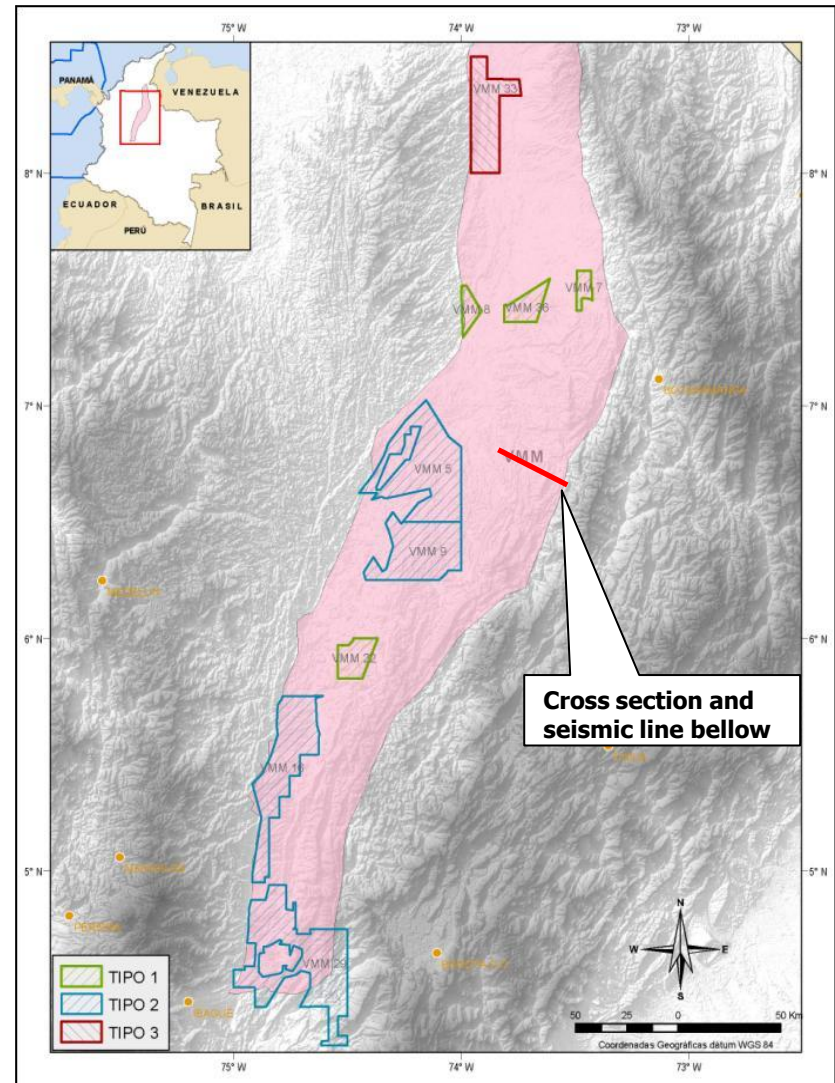


REGIONAL LINE: 2 (LINES PSJ-96-1870, 87-B-01 EXT.E)

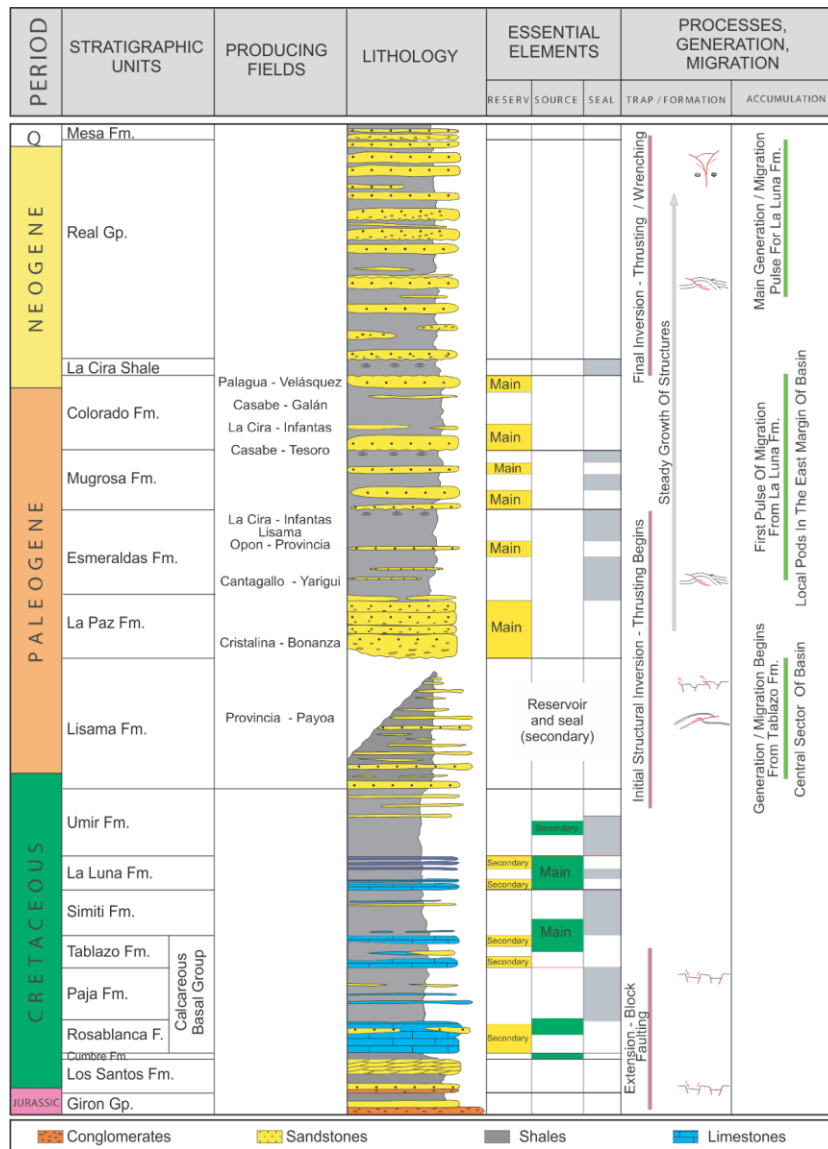


Middle Magdalena Valley Basin (VMM)

- It is one of the most prolific basins in Colombia with additional exploration potential.
- Unexplored Cretaceous carbonates.
- Potential ranges between 600 MMBBL and 8,000 MMBBL
- A preliminary assessment suggests that the basin is also prospective for *Shale Oil* and *Shale Gas*.

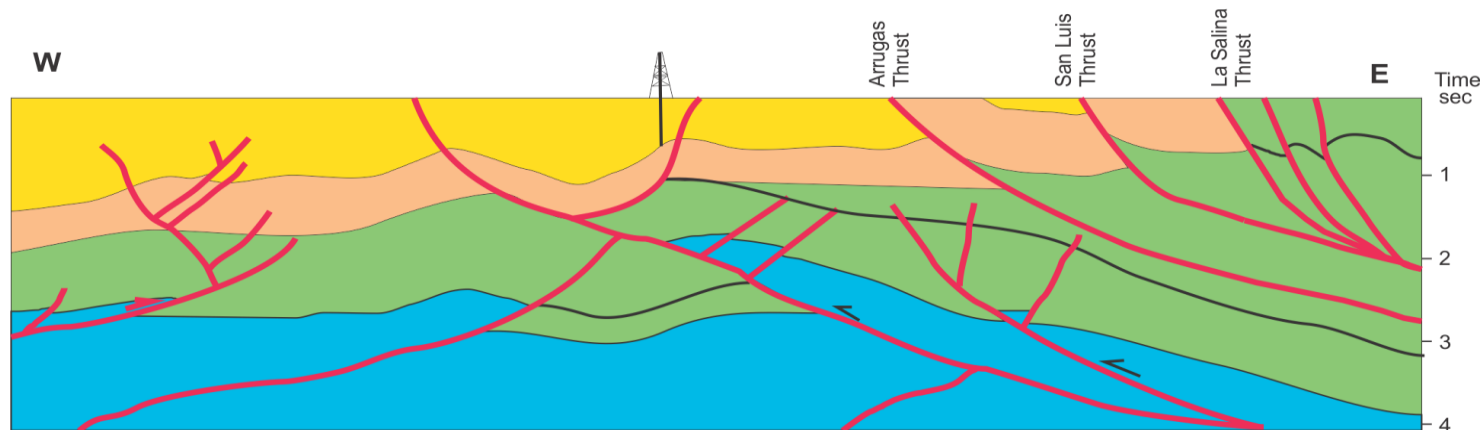


Middle Magdalena Valley Basin (VMM)

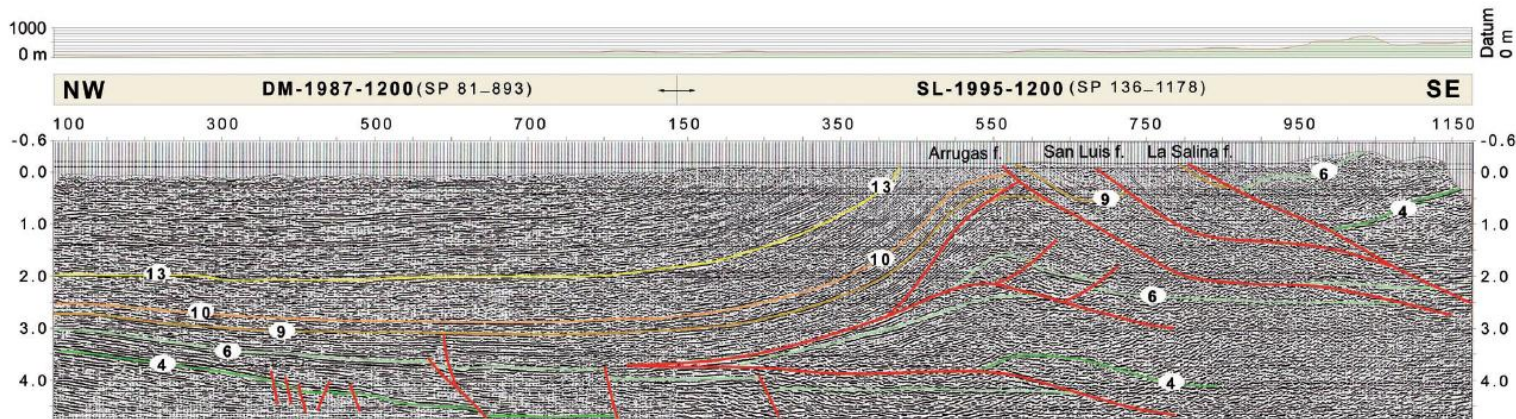


Middle Magdalena Valley Basin (VMM)

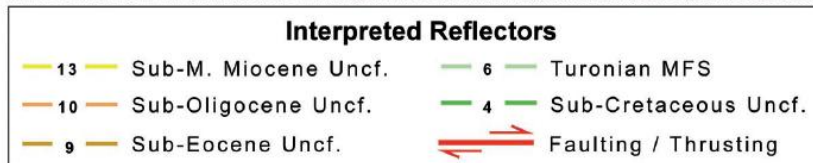
SCHEMATIC CROSS SECTION
MIDDLE MAGDALENA VALLEY BASIN



Color code according to the commission for the Geological Map of the World (2005)



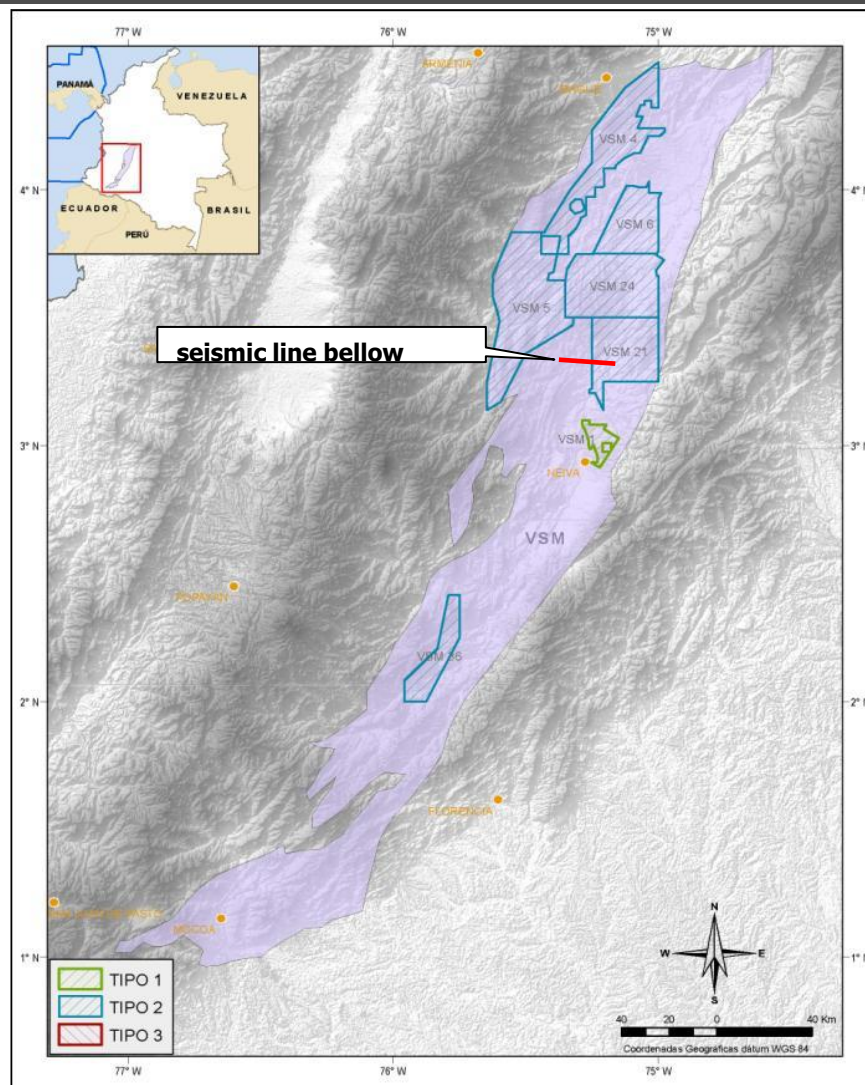
Geotec, Robertson Research, Ecopetrol (1998)



Southwestern and Foothills Domain

Upper Magdalena Valley Basin (VSM)

- Potential ranges between 550 MMBO and 1,400 MMBO.
- A preliminary assessment suggests that the basin is also prospective for *Shale Oil* and *Shale Gas*.



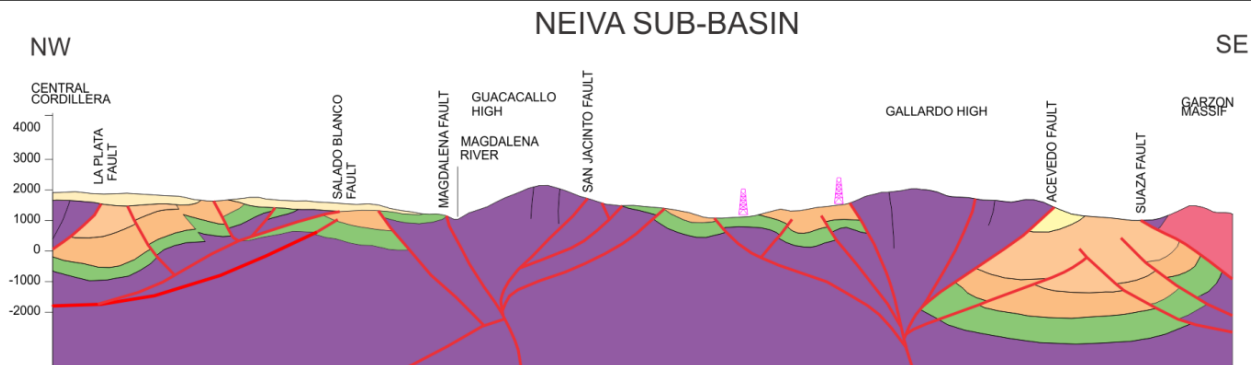
Upper Magdalena Valley Basin (VSM)

PERIOD	EPOCH	LITHOSTRATIGRAPHIC UNITS	LITHOLOGY	PETROLEUM SYSTEM	PALEO-ENVIRONMENT	MAIN FIELDS	
NEOGENE	Quaternary	Terraces, Aluvian Fans			Alluvial		
	Pliocene	Guacacallo Fm., Lajar de Altamira and other Units			Volcano-clastic (lahars)		
		Gigante Fm. (Mesa)					
Miocene	Honda Group	Villavieja Fm.		R	Fluvial	Rio Ceibas Andalucia	
		La Victoria Fm.					
	Barzalosa Fm.						
PALEOGENE	Upper Oligocene	Gualanday Group		R?	Alluvial to Fluvial		
	Upper to mid. Eocene	Doima Fm.					
		Potrerrillo Fm.					
	Paleocene to Lower Eocene	Chicoral Fm.		R			
CRETACEOUS	Maastrichtian	Monserrate / La Tabla / Tobo		R	Shallow Marine	Dina-K Tello Cebu	
		"Shale And Sands Level"					
	Campanian	Olini Group	Upper Shale		R	Platform to Marine	
			Shale Level / Arenisca el Cobre				
	Santonian		Lower Chert				
	Coniacian	Villeta Group	La Luna		S	Neritic	
			Turonian				
	Cenomanian		Bambuca				
	Upper Albian		Tetuan				
	Mid. Aptian?-Mid. Albian		Caballos Fm.		R	Shallow Marine Fluvial Estuarine	Yaguara San Francisco Balcon
Lower Aptian (Barremian)		Yavi Fm.		R?	Fluvial to Alluvial		
Pre - Cretaceous Basement (Saldaña Fm.)				Economic Basement			

LITHOLOGY			PETROLEUM SYSTEM		
Sandstones	Red and varicolored shales	Limestones	Main Reservoirs	Secondary Reservoirs, Seal And Sources.	
Conglomerates	Siliceous Shales	Intrusive Igneous Rocks	Main Sources	Main Seals	
Gray Shales	Marl	Vulcanites			

From Mora, J.A., 2003

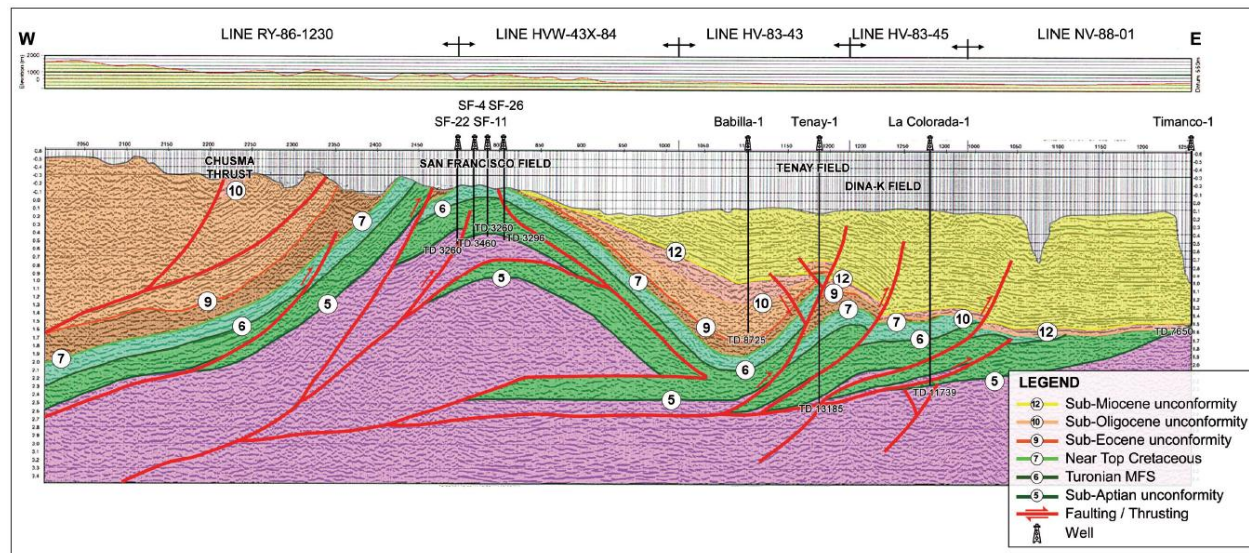
Upper Magdalena Valley Basin (VSM)



Taken from Fabre, 1995

Color code according to the commission for the Geological Map of the World (2005)

Precambrian
 Jurassic
 Cretaceous
 Paleogene
 Neogene

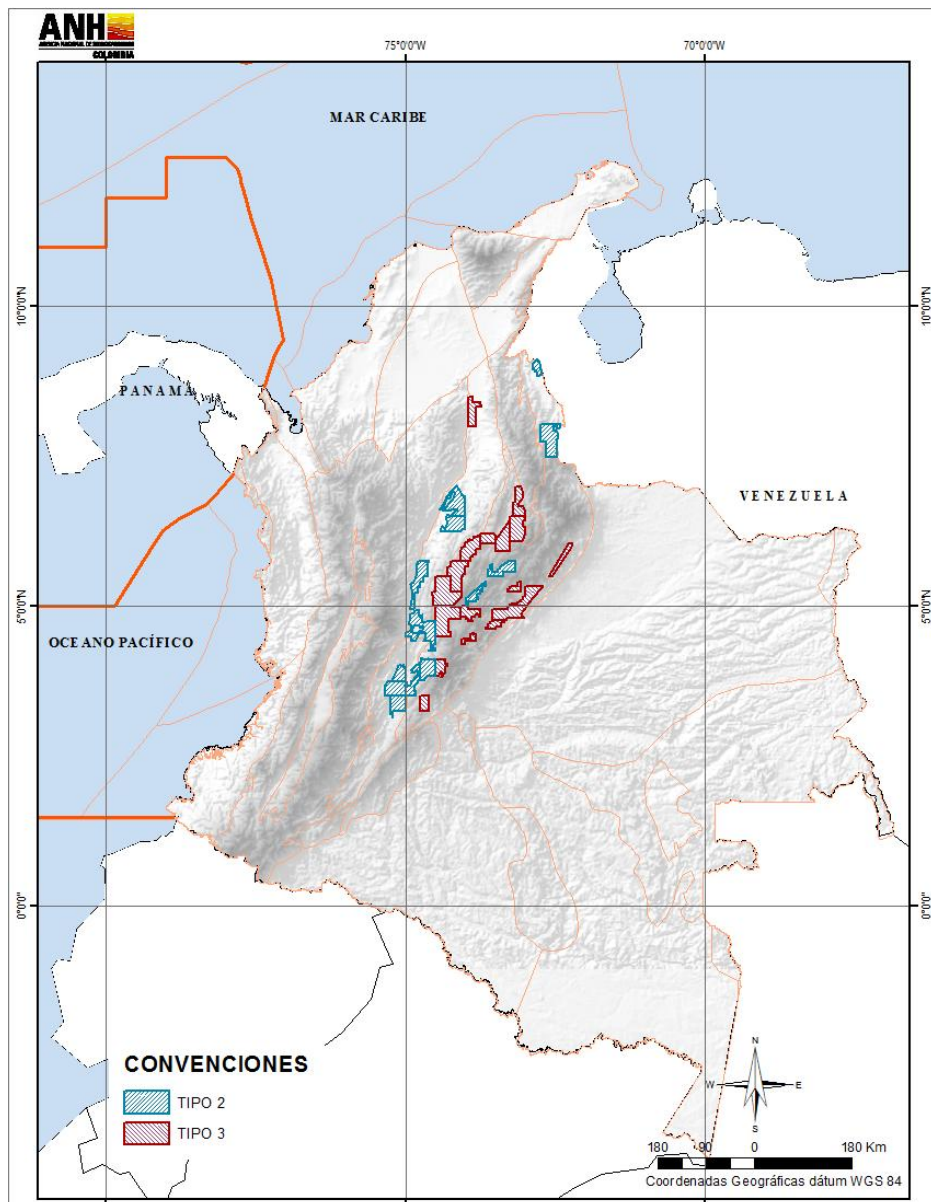


Content



1. Introduction
2. Colombian Round 2012
3. Technical aspects of Main Basins
- 4. Unconventional resources**
5. Database
6. Summary and Conclusions

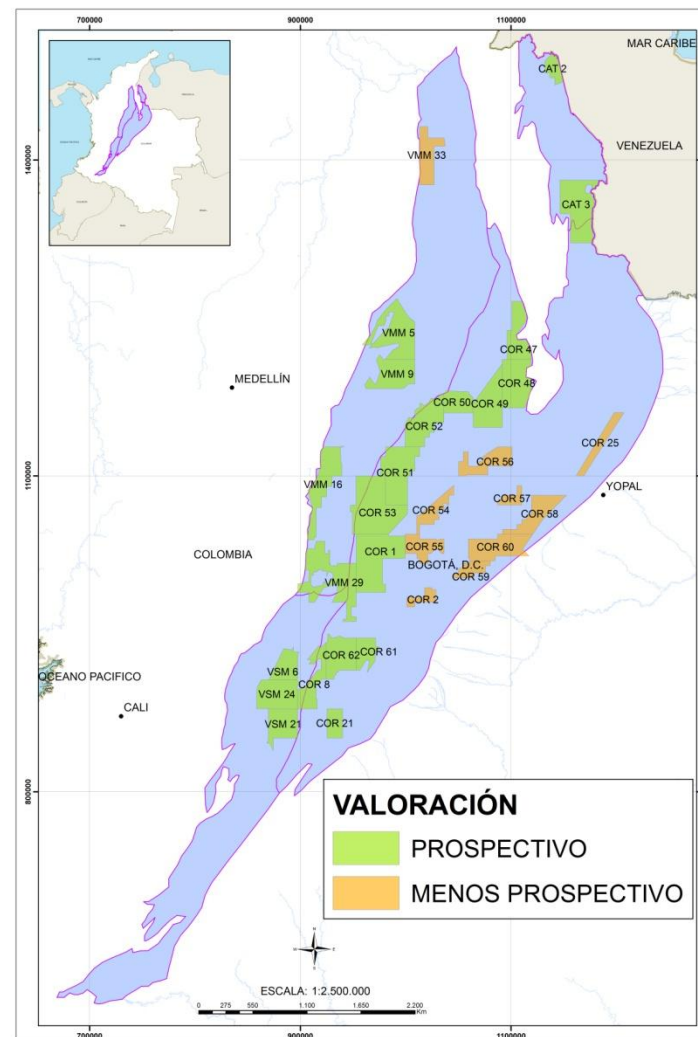
Bloques para No Convencionales



Prospectivity for Unconventional HC

RONDA 2012 NO CONVENCIONALES				
Valoración	Total de Bloques	Tipo I	Tipo II	Tipo III
Prospectivo	21	0	11	10
Menos Prospectivo	10	0	2	8

PROSPECTIVIDAD - NO CONVENCIONALES



Unconventional resources (Preliminary Assessment, Unal, 2011)

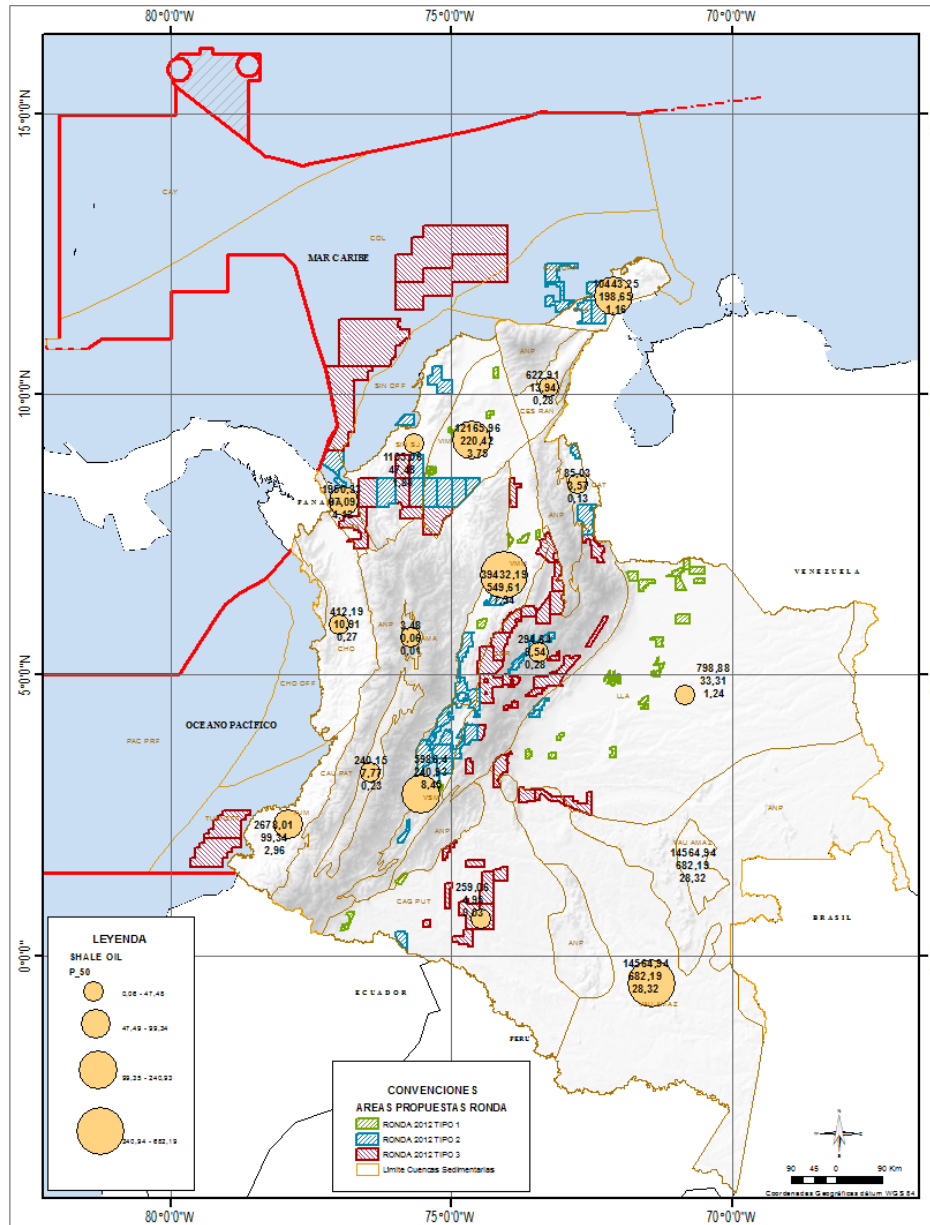
Recurso	Resultados (máximo - mínimo)	Cuencas más prospectivas (P ₅₀)
Hidratos de Gas	843.04 - 13,040.05 MMBOE (4.89 - 75.63 Tcf)	Chocó Marino Guajira Marino Sinú Marino
Gas asociado al Carbón	Escenario 1: 125.22 - 13,363.92 MMBOE (725.39 - 73,107.17 Bcf) Escenario 2: 2,535.24 - 3,783.05 MMBOE (14,704.50 - 21,940.83 Bcf) Escenario 3: 27.14 - 61.97 MMBOE (156.10 - 359.56 Bcf)	Sinú-San Jacinto Cesar-Ranchería Valle Superior del Magdalena
Tar Sand	Escenario 1: 22.63 - 990.45 MMbbl Recursos Medidos Escenario 2: 155.71 - 6812.57 MMbbl Recursos Indicados Escenario 3: 1,056.94 - 46,244.82 MMbbl Recursos Inferidos Escenario 4: 3,455.13 - 151,173.86 MMbbl Recursos Hipotéticos	Cordillera Oriental Llanos Orientales Valle Medio del Magdalena
Shale Oil	Escenario 1: 60.47 - 91,077.98 MMbbl Recursos Indicados Escenario 2: 511.67 - 677,745.15 MMbbl Recursos Hipotéticos	Cordillera Oriental Chocó Valle Superior del Magdalena

Unconventional resources (Preliminary Assessment, Unal, 2011)

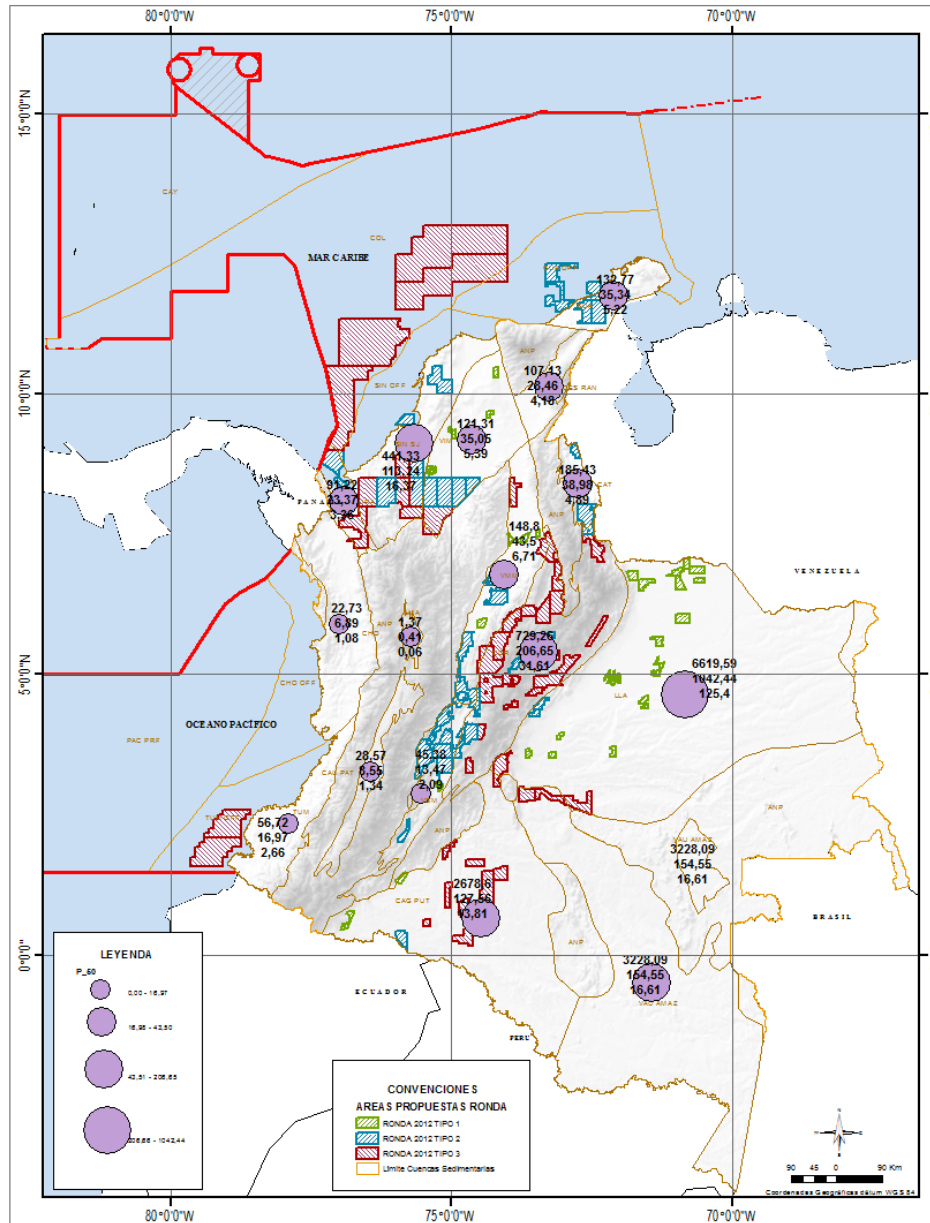


Recurso	Resultados (máximo - mínimo)	Cuencas más prospectivas (P ₅₀)
Shale Gas	Escenario 1: 41,513.49 – 2,525,394.17 MMBOE (240.78 – 14,647.29 Tcf) Escenario 2: 71,080.00 – 3,800,460.00 MMBOE (412.29 – 22,042.67 Tcf)	Llanos Orientales Cordillera Oriental Caguán-Putumayo
Gas en arenas apretadas	Escenario 1: 0.82 – 1,089.32 MMBOE (0.005 – 6.32 Tcf) Escenario 2: 172.06 – 7,530.59 MMBOE (0.99 – 43.67 Tcf)	Llanos Orientales Caguán-Putumayo Cordillera Oriental
Crudo Pesado	14,224 – 388,654 MMbbl	Llanos Orientales Valle Medio del Magdalena Caguán-Putumayo

Unconventional resources: *Shale Oil* Potential



Unconventional Resources: - *Shale Gas Potential*



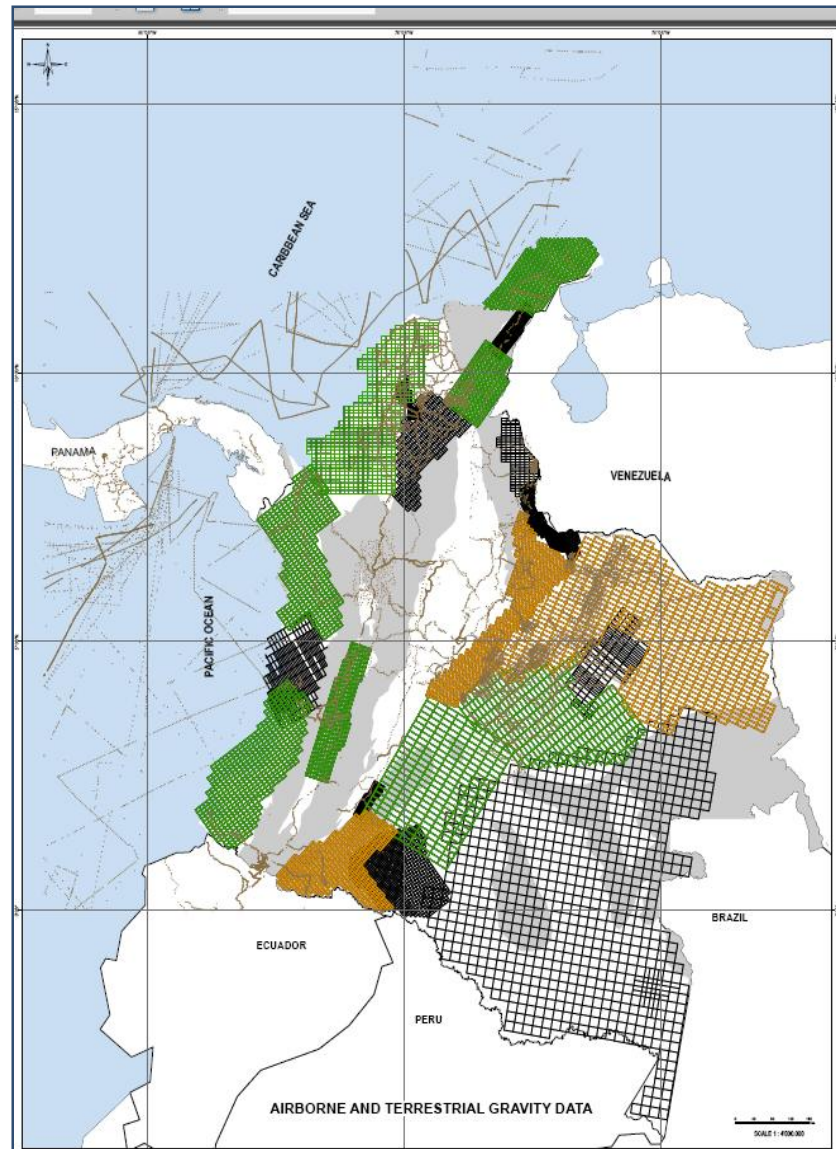
Content



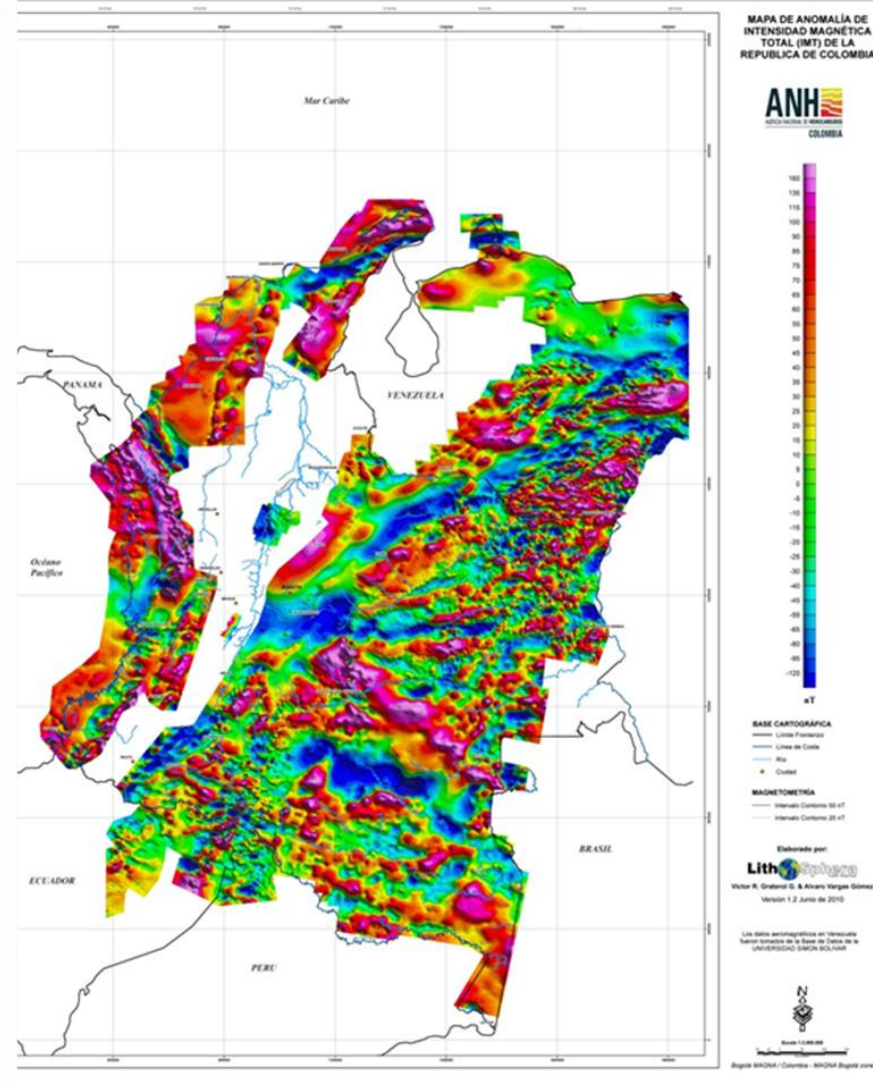
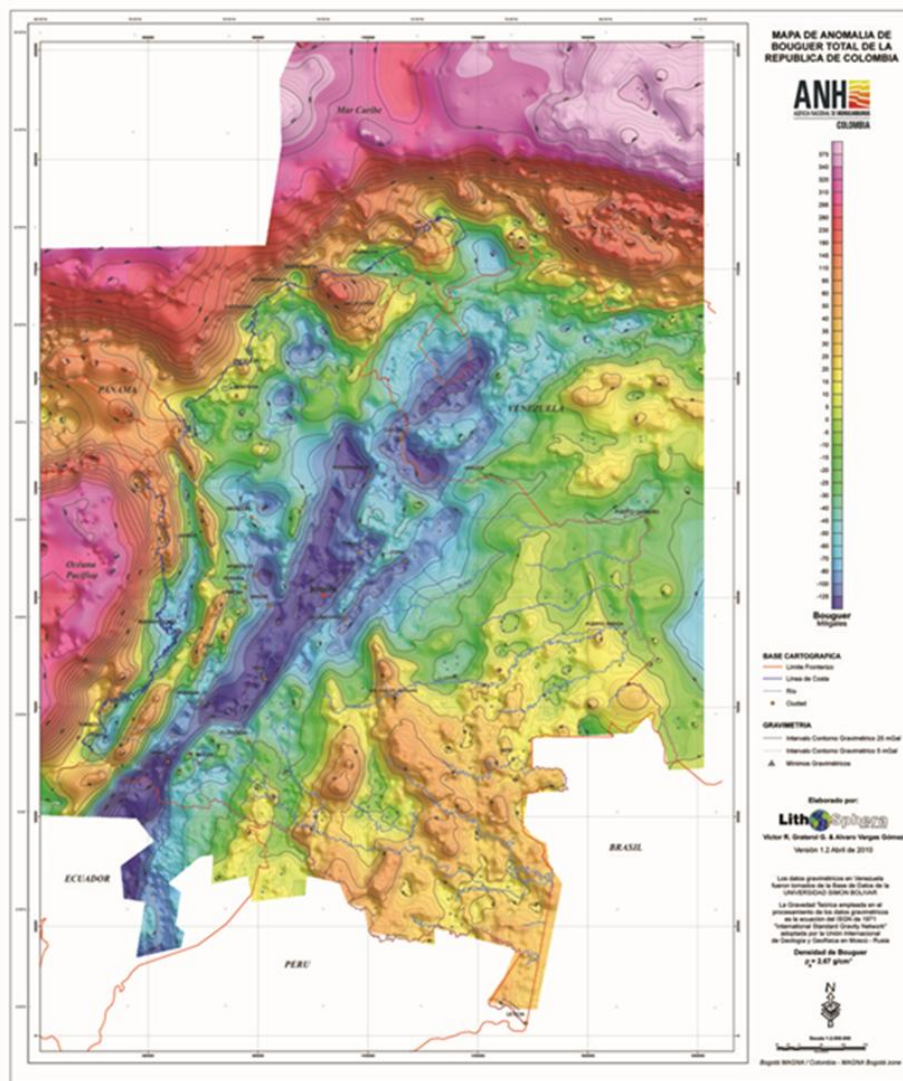
1. Introduction
2. Colombian Round 2012
3. Technical aspects of Main Basins
4. Unconventional resources
5. Database
6. Summary and Conclusions

Database Airborne Geophysical Coverage

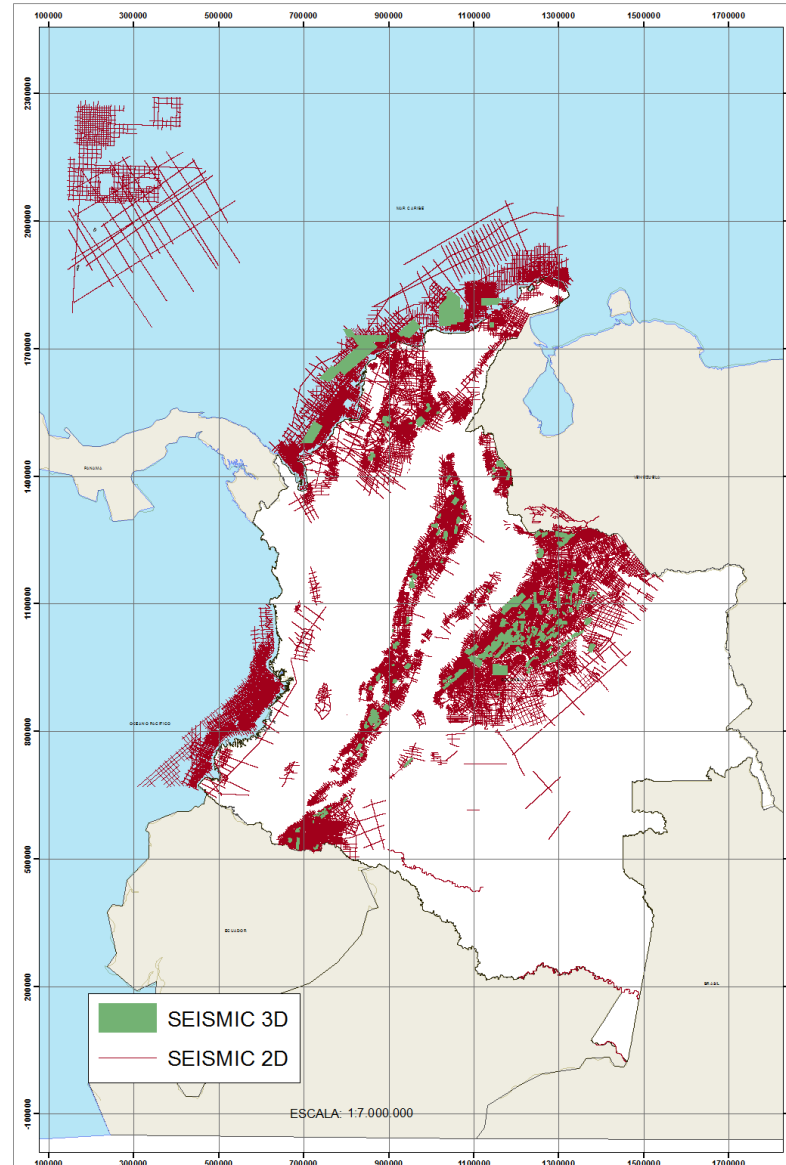
-  ANH 2005-
-  ANH 2008-2009



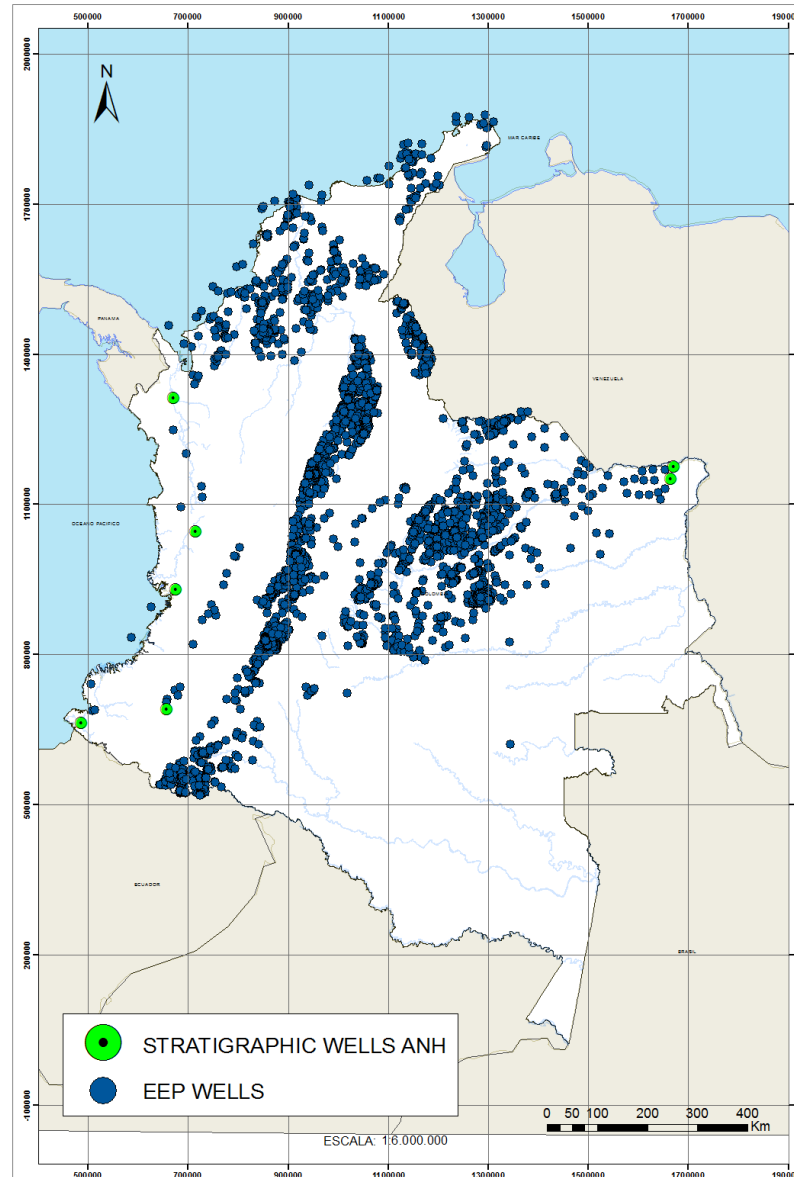
Database Gravity and Magnetic Anomalies Maps



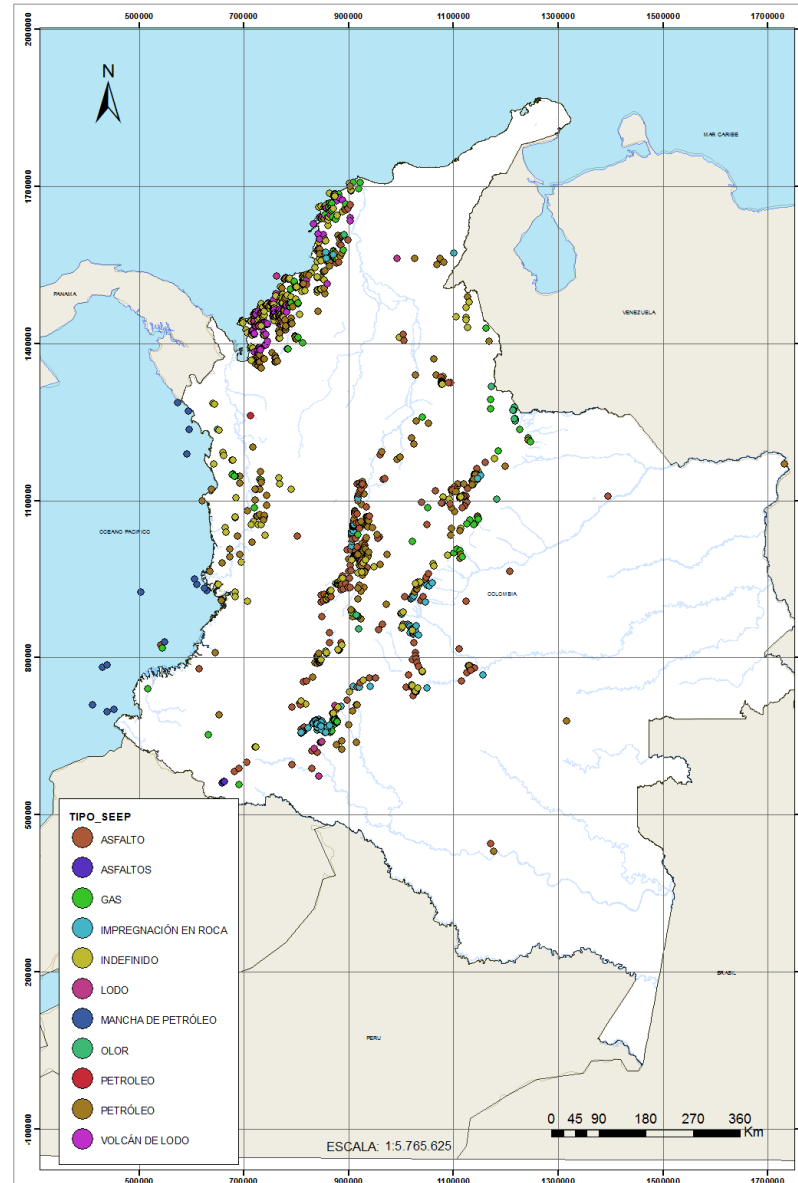
2D and 3D seismic coverage



Exploration, Evaluation, Production – EEP and Stratigraphic wells Map



Oil and Gas Seeps



Content



1. Introduction
2. Colombian Round 2012
3. Technical aspects of Main Basins
4. Unconventional resources
5. Database
6. Summary and Conclusions

Summary and Conclusions



***New Ideas + New Technologies
+ New Licenses***

=



Significant new discoveries

Summary and Conclusions

- Colombia offers excellent exploration opportunities, on a global scale, for the discovery of significant additional reserves in mature, emerging and frontier basins.
- Such opportunities encompass both, conventional and unconventional hydrocarbon resources





www.anh.gov.co
rondacolombia2012@anh.gov.co