

# Potencial de hidrocarburos en Colombia

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**Diciembre, 2011**

Comprende la evaluación del potencial de hidrocarburos convencionales y no-convencionales en Colombia mediante la utilización del método estadístico de Montecarlo.

- Potencial de Hidrocarburos en Colombia
- Hidratos de gas metano (Gas Hydrate)
- Gas asociado a carbón (Coal Bed methane)
- Arenas Bituminosas (Tar Sands)
- Petr leo de Shales (Shale Oil)
- Gas de Shales (Shale Gas)
- Arenas apretadas (Tight gas)

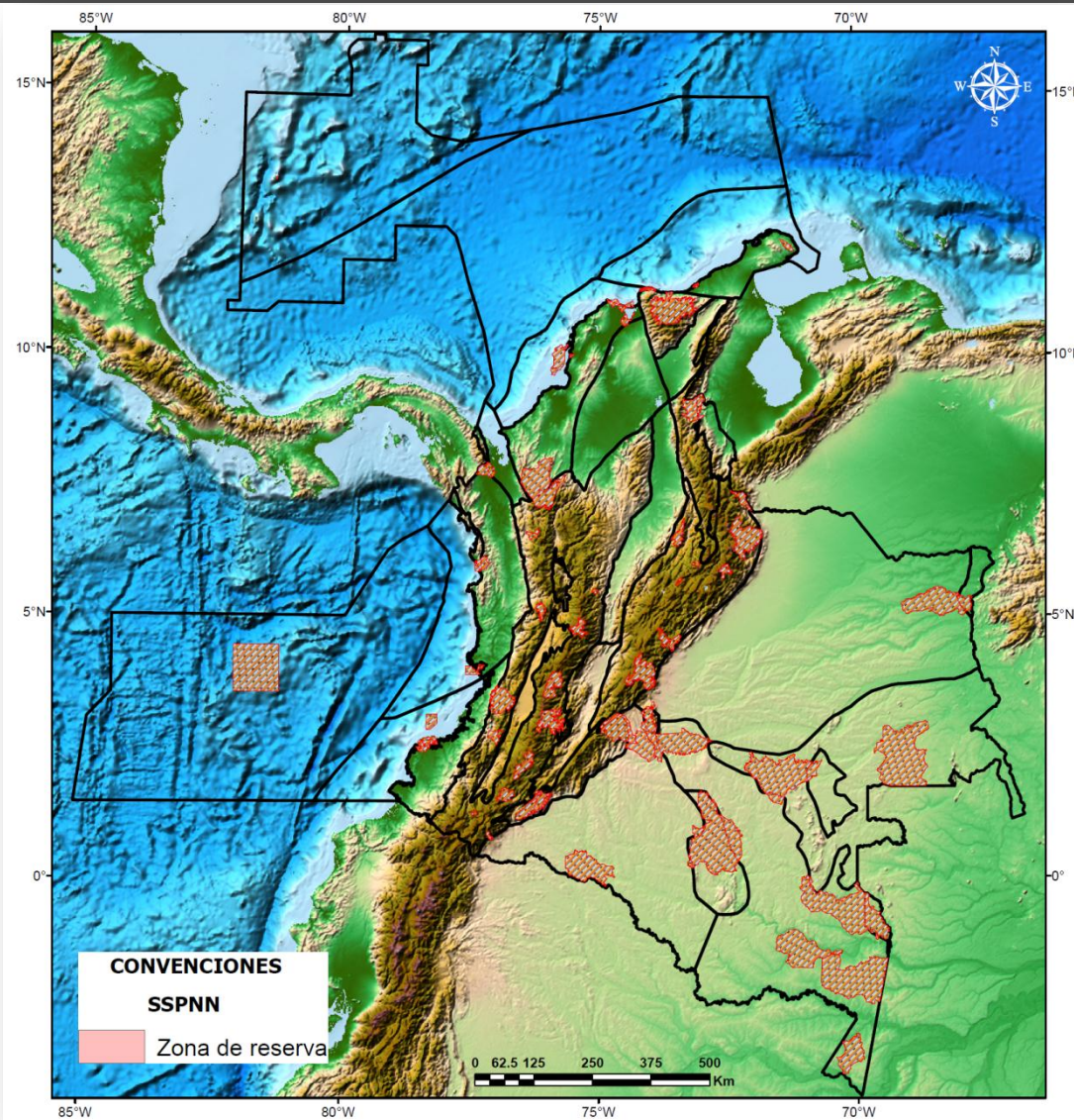
✓ **Generalidades y datos disponibles**

✓ **M todos e Hip tesis**

✓ **Estimaci n**



Cuenca	Porcentaje
AMAGA	0.0%
AREA NO PROSPECTIVA	13.3%
CAGUAN-PUTUMAYO	7.8%
GUAJIRA OFFSHORE	0.1%
SINU OFFSHORE	5.3%
CATATUMBO	5.8%
CAUCA PATIA	0.0%
LOS CAYOS	0.0%
CESAR RANCHERIA	0.0%
CHOCO	2.1%
COLOMBIA	0.0%
PACIFICO PROFUNDO COLOMBIANO	3.6%
CORDILLERA ORIENTAL	10.9%
GUAJIRA	2.3%
LLANOS ORIENTALES	2.3%
CHOCO OFFSHORE	1.6%
TUMACO OFFSHORE	3.1%
SINU-SAN JACINTO	10.3%
TUMACO	2.5%
URABA	3.1%
VALLE INFERIOR DEL MAGDALENA	0.0%
VALLE MEDIO DEL MAGDALENA	0.0%
VALLE SUPERIOR DEL MAGDALENA	7.2%
VAUPES-AMAZONAS	21.6%



## Potencial de Hidrocarburos en Colombia

- **Balance de Masa**
- **OOIP**
- **YTF**

## - Balance de Masas

TOC + HI  $\longrightarrow$  **Hidrocarburo total generado** por cuenca.

## - OOIP

Estimación volumétrica  $\longrightarrow$  Potencial de **hidrocarburo original In situ**.

## - Fractal

Reservas conocidas  $\longrightarrow$  **Reservas por descubrir**

## BP Statistical Review of World Energy June 2011



bp.com/statisticalreview

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## Oil

### Proved reserves

	At end 1990 Thousand million barrels	At end 2000 Thousand million barrels	At end 2009 Thousand million barrels	At end 2010			R/P ratio
				Thousand million tonnes	Thousand million barrels	Share of total	
US	33.8	30.4	30.9	3.7	30.9	2.2%	11.3
Canada	11.2	18.3	32.1	5.0	32.1	2.3%	26.3
Mexico	51.3	20.2	11.7	1.6	11.4	0.8%	10.6
<b>Total North America</b>	<b>96.3</b>	<b>68.9</b>	<b>74.6</b>	<b>10.3</b>	<b>74.3</b>	<b>5.4%</b>	<b>14.8</b>
Argentina	1.6	3.0	2.5	0.3	2.5	0.2%	10.6
Brazil	4.5	8.5	12.9	2.0	14.2	1.0%	18.3
Colombia	2.0	2.0	1.4	0.3	1.9	0.1%	6.5
Ecuador	1.4	4.6	6.3	0.9	6.2	0.4%	34.1
Peru	0.8	0.9	1.1	0.2	1.2	0.1%	21.6
Trinidad & Tobago	0.6	0.9	0.8	0.1	0.8	0.1%	15.6
Venezuela	60.1	76.8	211.2	30.4	211.2	15.3%	*
Other S. & Cent. America	0.6	1.3	1.4	0.2	1.4	0.1%	28.9
<b>Total S. &amp; Cent. America</b>	<b>71.5</b>	<b>97.9</b>	<b>237.6</b>	<b>34.3</b>	<b>239.4</b>	<b>17.3%</b>	<b>93.9</b>
Azerbaijan	n/a	1.2	7.0	1.0	7.0	0.5%	18.5
Denmark	0.6	1.1	0.9	0.1	0.9	0.1%	9.9
Italy	0.8	0.9	1.0	0.1	1.0	0.1%	25.0
Kazakhstan	n/a	25.0	39.8	5.5	39.8	2.9%	62.1
Norway	8.6	11.4	7.1	0.8	6.7	0.5%	8.5
Romania	1.5	1.2	0.5	0.1	0.5	*	14.8
Russian Federation	n/a	59.0	76.7	10.6	77.4	5.6%	20.6
Turkmenistan	n/a	0.5	0.6	0.1	0.6	*	7.6
United Kingdom	4.0	4.7	2.8	0.4	2.8	0.2%	5.8
Uzbekistan	n/a	0.6	0.6	0.1	0.6	*	18.7
<b>Other Europe &amp; Eurasia</b>	<b>65.3</b>	<b>2.3</b>	<b>2.3</b>	<b>0.3</b>	<b>2.4</b>	<b>0.2%</b>	<b>17.5</b>
<b>Total Europe &amp; Eurasia</b>	<b>80.8</b>	<b>107.9</b>	<b>139.2</b>	<b>19.0</b>	<b>139.7</b>	<b>10.1%</b>	<b>21.7</b>
Iran	92.9	99.5	137.0	18.8	137.0	9.9%	88.4
Iraq	100.0	112.5	115.0	15.5	115.0	8.3%	*
Kuwait	97.0	96.5	101.5	14.0	101.5	7.3%	*
Oman	4.4	5.8	5.5	0.7	5.5	0.4%	17.4
Qatar	3.0	16.9	25.9	2.7	25.9	1.9%	45.2
Saudi Arabia	260.3	262.8	264.6	36.3	264.5	19.1%	72.4
Syria	1.9	2.3	2.5	0.3	2.5	0.2%	17.8
United Arab Emirates	98.1	97.8	97.8	13.0	97.8	7.1%	34.1
Yemen	2.0	2.4	2.7	0.3	2.7	0.2%	27.7
Other Middle East	0.1	0.2	0.1	t	0.1	*	9.3
<b>Total Middle East</b>	<b>659.6</b>	<b>696.7</b>	<b>752.6</b>	<b>101.8</b>	<b>752.5</b>	<b>54.4%</b>	<b>81.9</b>

**Notes:** Proved reserves of oil – Generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions. Reserves-to-production (R/P) ratio – If the reserves remaining at the end of any year are divided by the production in that year, the result is the length of time that those remaining reserves would last if production were to continue at that rate. Source of data – The estimates in this table have been compiled using a combination of primary official sources, third-party data from the OPEC Secretariat, Oil & Gas Journal and an independent estimate of Russian reserves based on information in the public domain. Canadian proved reserves include an official 26.5 billion barrels for oil sands 'under active development'. Venezuelan reserves are taken from the OPEC Annual Statistical Bulletin, that noted in 2008 that the figure included 'proven reserves of the Magna Reserve Project in the Orinoco Belt, which amounted to 94,168mb'. Reserves include gas condensate and natural gas liquids (NGLs) as well as crude oil.

$$\text{HC generado por Cuenca} = \text{TOC}/100 \times \rho_F \times \text{Área} \times \text{Espesor} \times R \times 10^{-6}$$

TOC/100 (wt%)	×	Densidad Formacion (p.g /cm <sup>3</sup> )	×	Unidad de Volumen (V,cm <sup>3</sup> )	=	Masa de carbono Organico (M, g TOC)
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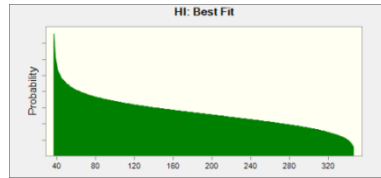
Indice de Hidrogeno antes de la generacion de H.C (Hlo. mg HC/g TOC)	-	Indice de hidrogeno presente (Hlp, mg HC/g TOC)	=	Hidrocarburos Generados por gramo de carbono organico (R, mg HC/g TOC)	(R)
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R (mg HC/g TOC)	×	M (g TOC)	×	10 <sup>-6</sup> (kg/mg)	=	Hidrocarburos generados por Unidad (HCG, kg HC)
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*(Schmoker, 1994)*



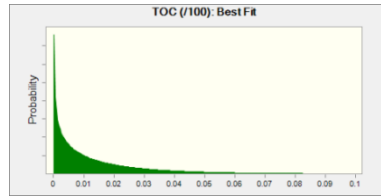
## General



Espesores

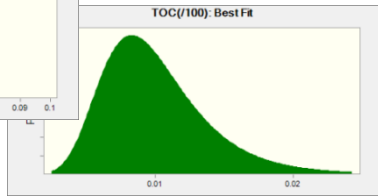
$$\rho_r = 2.4 \text{ g/cm}^3$$

## Caguán Putumayo

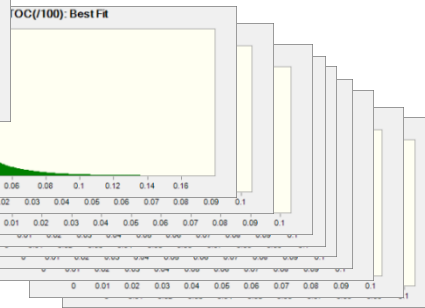


Sinú Offshore

TOC

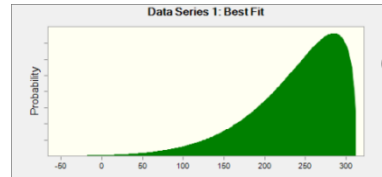


VSM

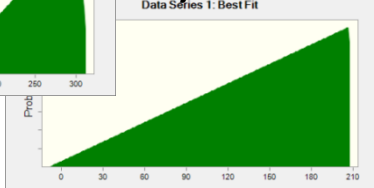


## Catatumbo

Guajira Offshore

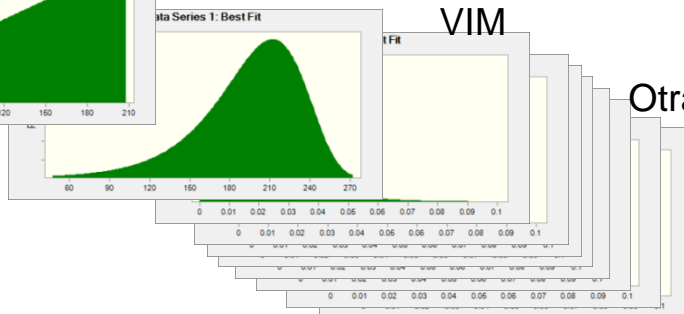


R



VIM

Otras



Otras

Cuenca	Área (km <sup>2</sup> )
Catatumbo	7,715
Cesar Ranchería	11,668
Cordillera Oriental	71,766
Llanos Orientales	225,603
Sinu Offshore	29,576
Sinu San Jacinto	39,644
Tumaco	23,732
VIM	38,017
VMM	32,949
VSM	21,512
Caguan-Putumayo	52,860
Guajira Offshore	110,304

HC entrampado → Riesgo geológico [Generación – Acumulación – Preservación]

(Hunt,1995)

Total de Hidrocarburo acumulado

P <sub>10</sub>	2,345 10 <sup>3</sup> MMBOE
P <sub>50</sub>	409 10 <sup>3</sup> MMBOE
P <sub>90</sub>	68 10 <sup>3</sup> MMBOE

~ **2.2 %**

Total de aceite acumulado

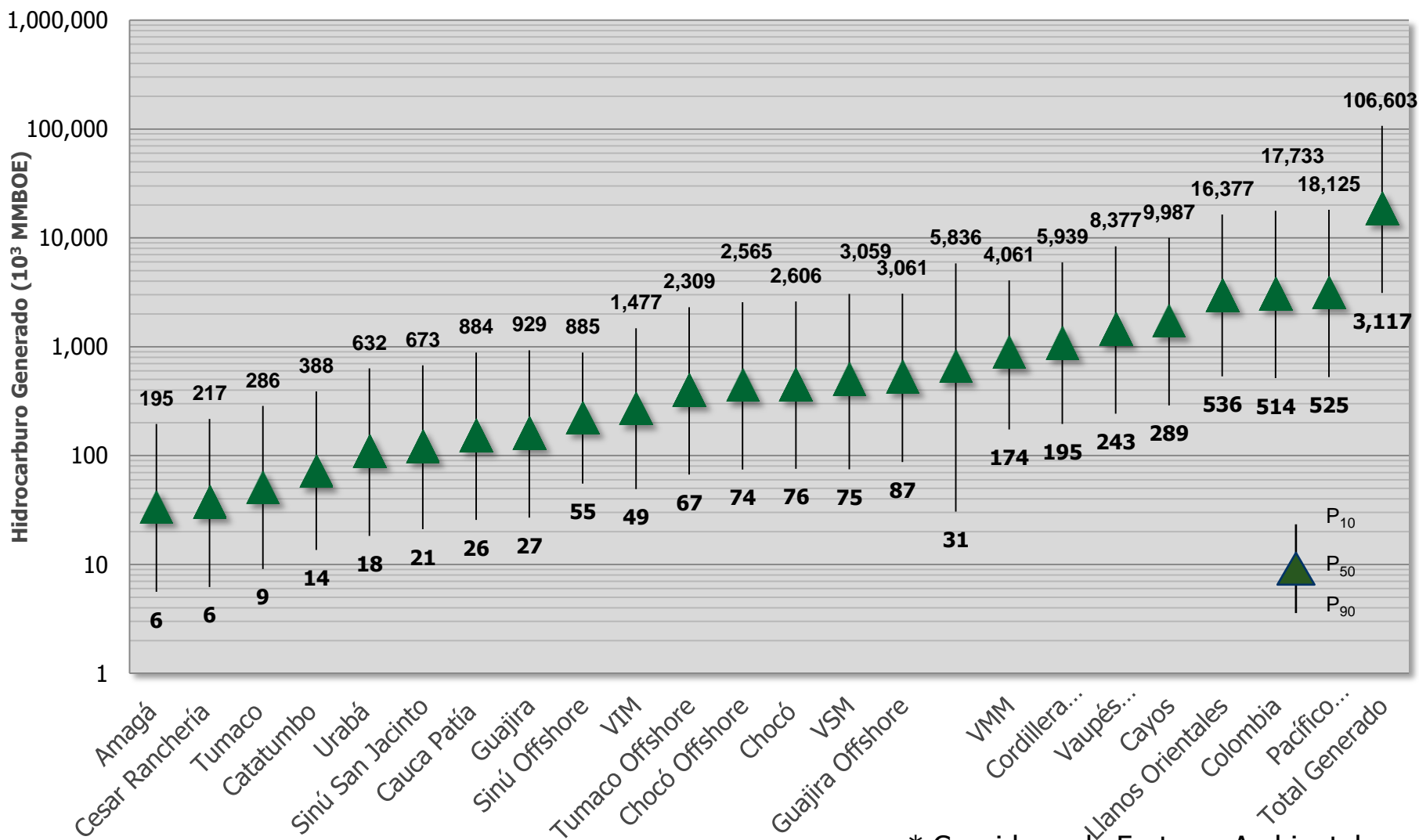
P <sub>10</sub>	1,918 10 <sup>3</sup> MMbbl
P <sub>50</sub>	335 10 <sup>3</sup> MMbb
P <sub>90</sub>	56 10 <sup>3</sup> MMbb

~ **1.8 %**

Total de gas acumulado

P <sub>10</sub>	2,558 Tcf
P <sub>50</sub>	447 Tcf
P <sub>90</sub>	75 Tcf

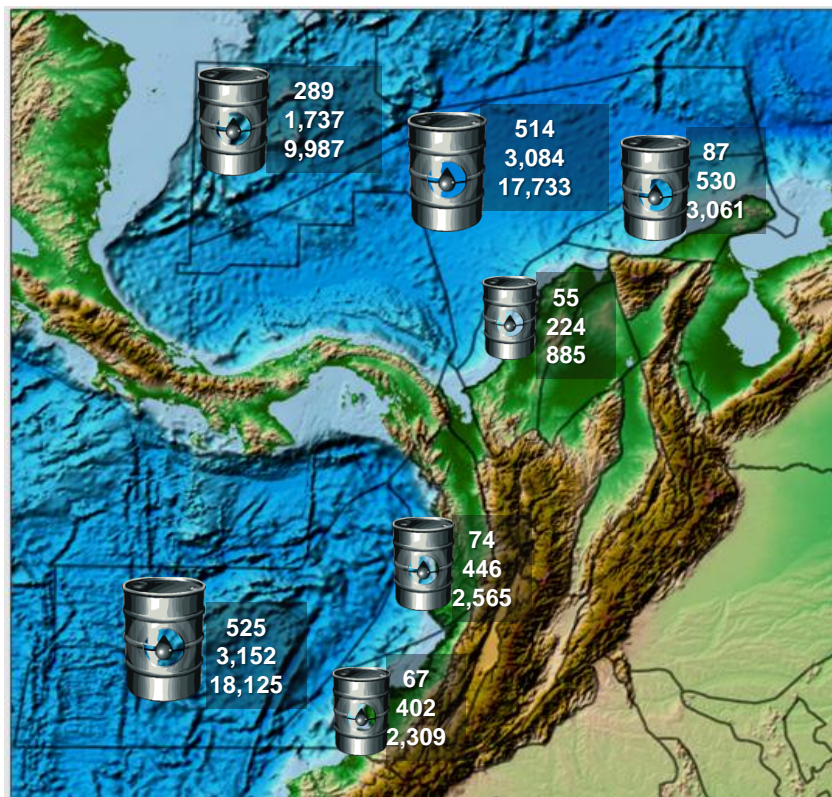
~ **0.4 %**



\* Considerando Factores Ambientales

## Onshore

## Offshore



## Recurso Original In situ

1.- Para cinco (5) cuencas

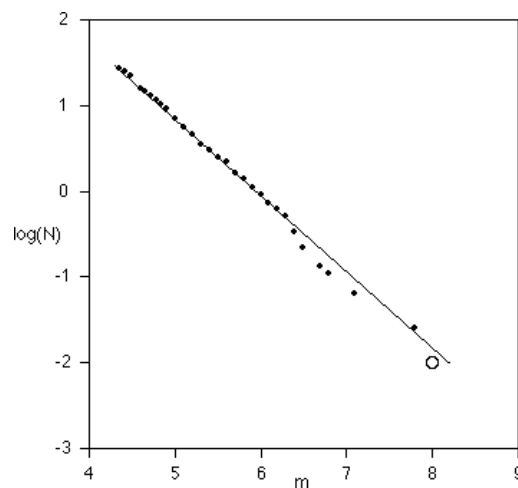
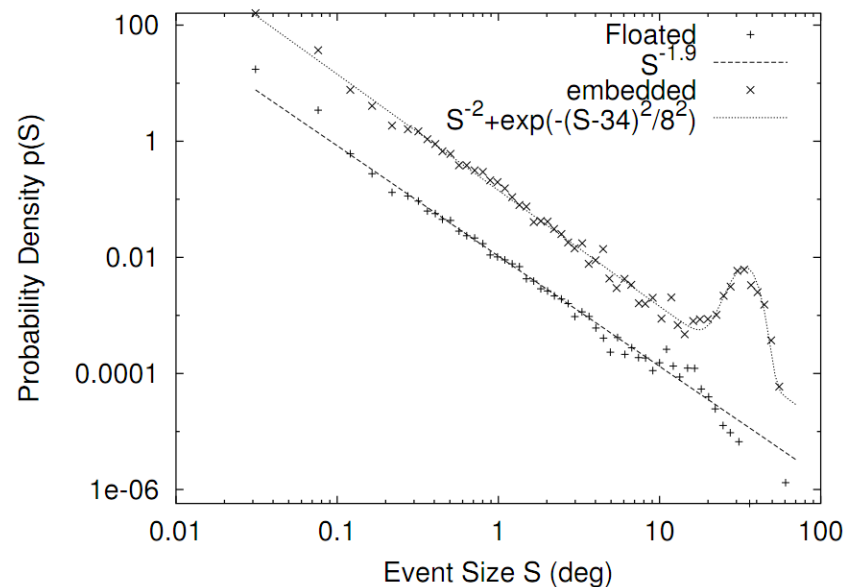
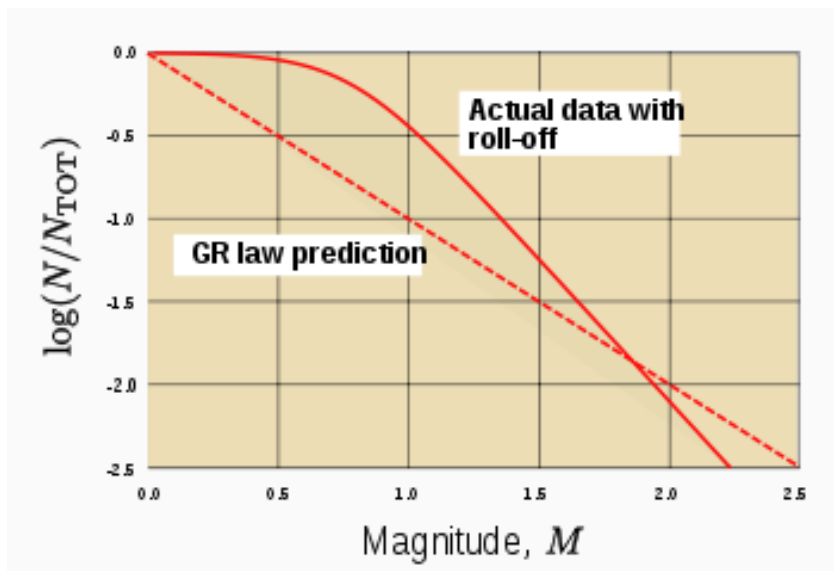
- **Área** → total áreas productoras por cuenca

Distribuciones → **Espesor – Porosidad - Sw - Bo**  
(Informes de prospectividad, ANH)

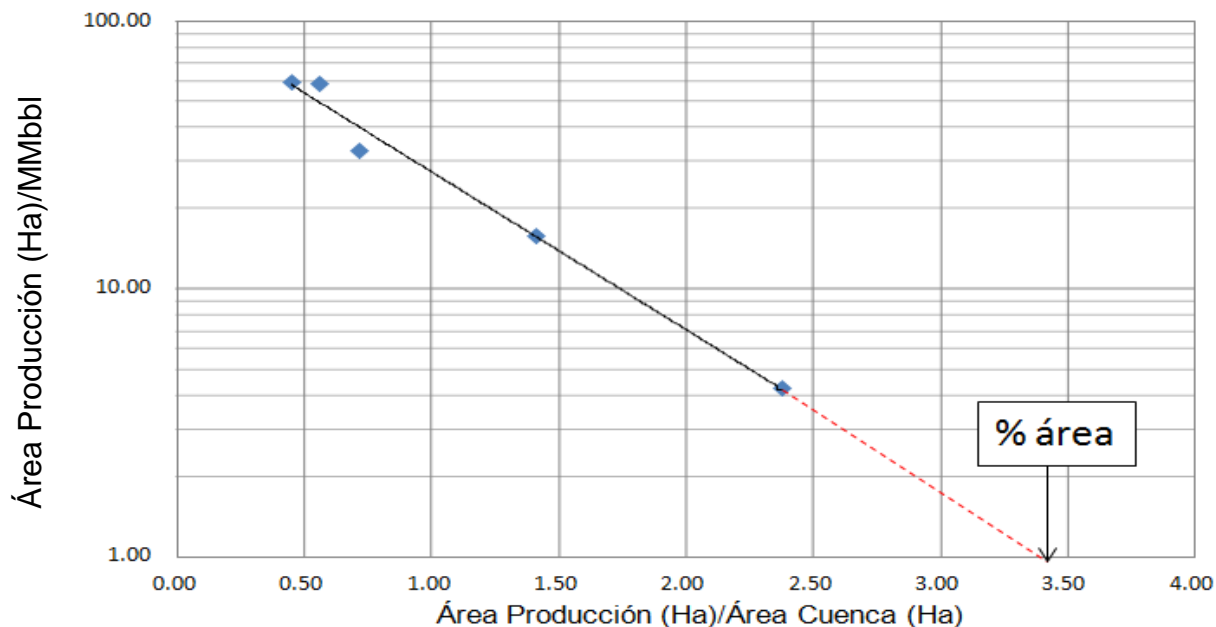
2.- Para el resto de las cuencas

- **Área** → relación de datos de áreas de producción (Vargas, 2009).

- Única distribución → **Espesor – Porosidad - Sw - Bo**  
(Informes de prospectividad, ANH)

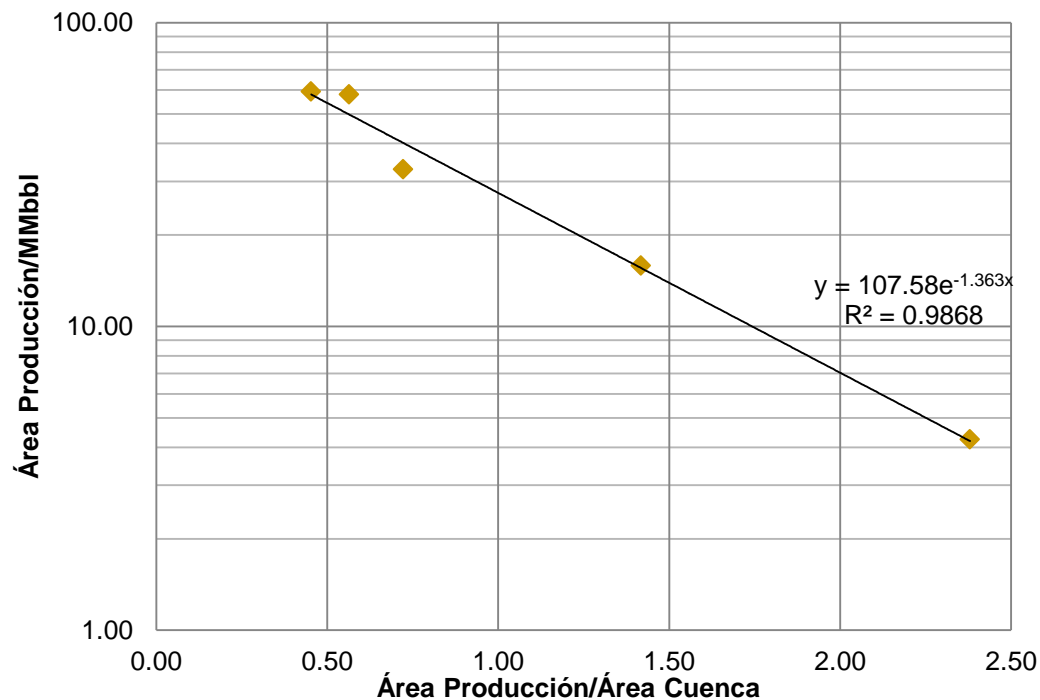


Cuenca	Área Cuenca (Ha)	Área Producción (Ha)	MMbbl	Aprod./Acuenca x 100	Aprod.(Ha)/MMbbl
<b>Caguan-Putumayo</b>	11030406.70	29834.23	514.44	0.27	57.99
<b>Llanos Orientales</b>	22560327.16	102248.96	1723.89	0.45	59.31
<b>VSM</b>	2151283.63	15539.52	472.72	0.72	32.87
<b>VMM</b>	3294941.89	46695.06	2952.03	1.42	15.82
<b>Catatumbo</b>	771501.27	18359.82	4325.70	2.38	4.24





Área P. (Ha)/MMbbl	% x 100
59.31	0.45
57.99	0.27
32.87	0.72
15.82	1.42
4.24	2.38



$$x = -\frac{\ln\left(\frac{1}{107.5}\right)}{1.36}$$

**x ~ 3.44 %**

$$OOIP = \frac{7758 * A * h * \phi * (1 - S_w)}{B_{oi}}$$

donde:

7758 = factor de conversión de acres-pies a barriles

A = área del reservorio (acres)

h = espesor total del reservorio (pies)

$\phi$  = porosidad de la formación

$S_w$  = saturación de agua

$B_{oi}$  = factor volumétrico

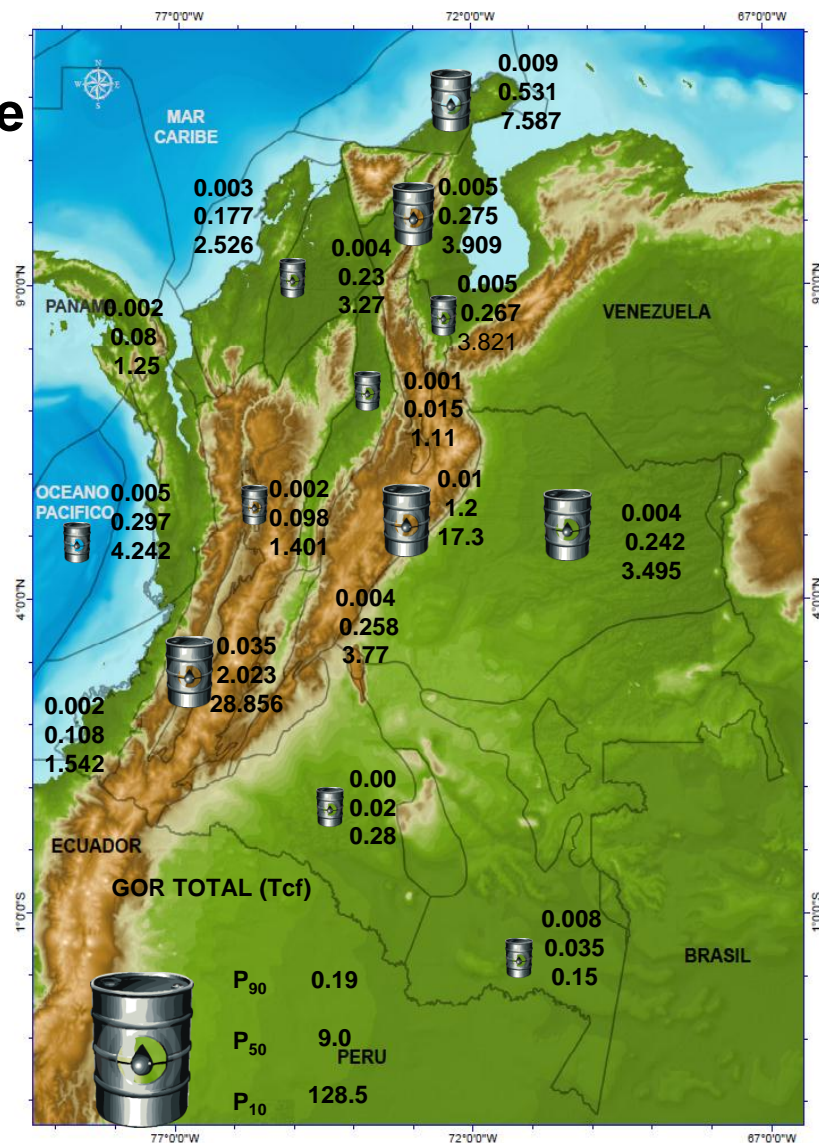
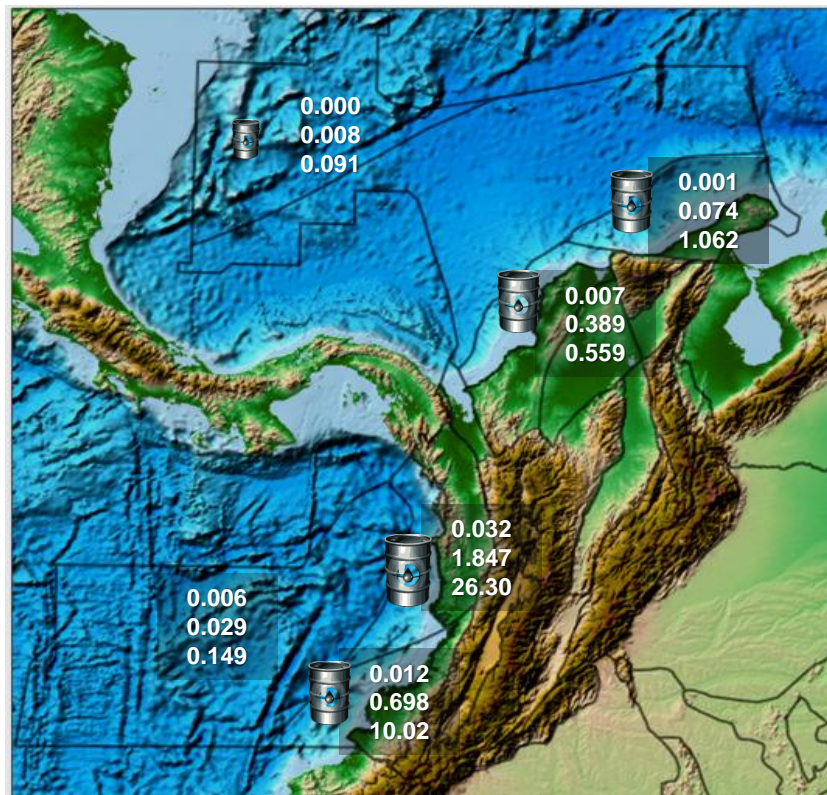
## Onshore

## offshore



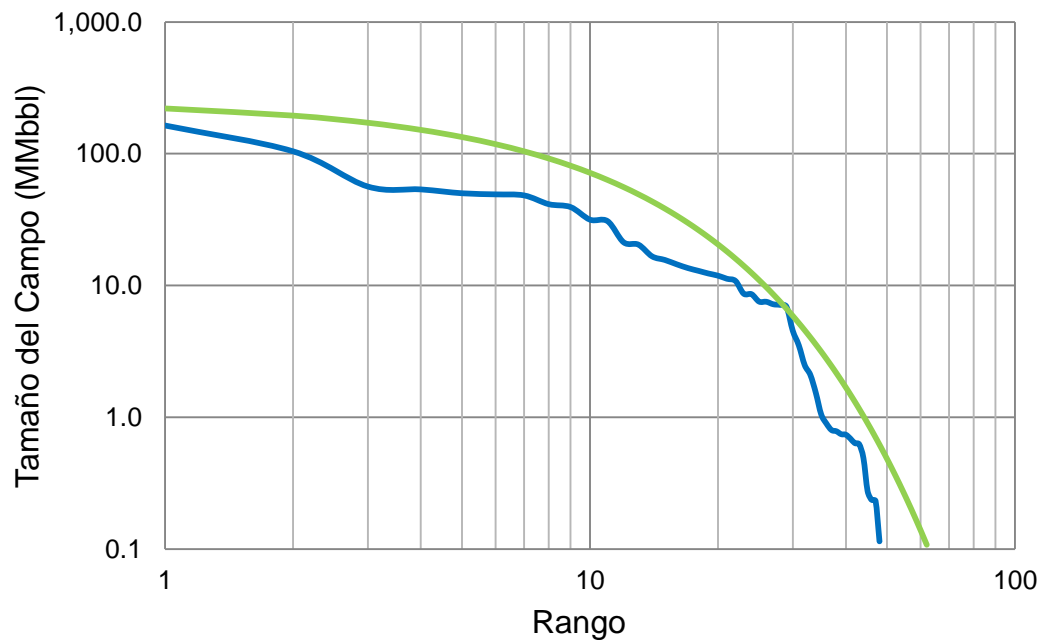
## Onshore

## offshore

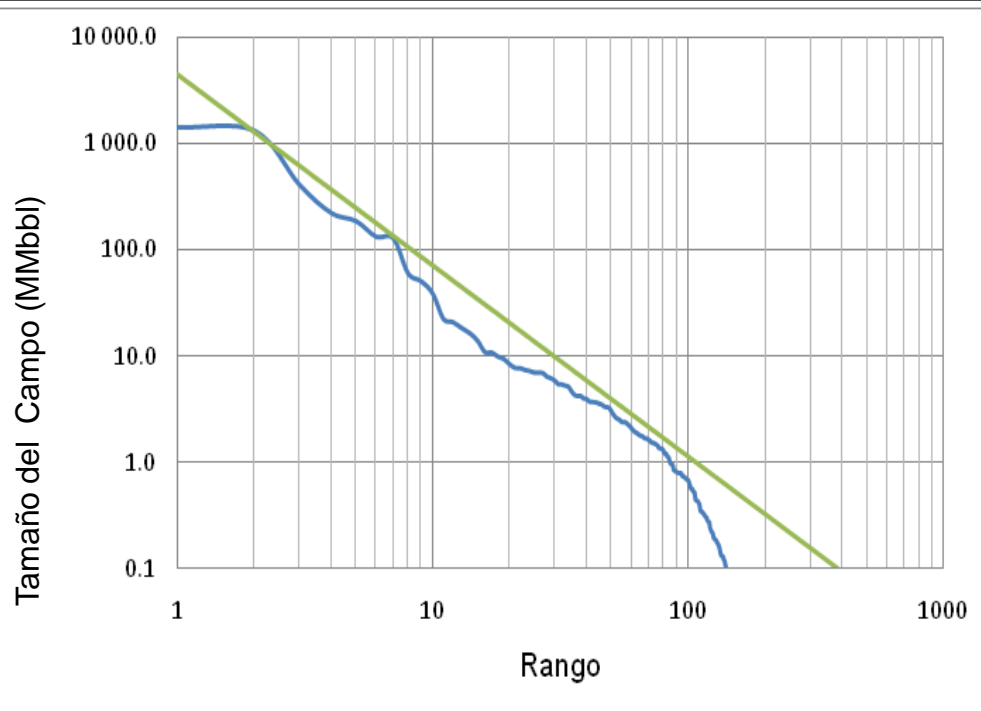


# Hidrocarburos por Encontrar (YTF)

*El total de recursos contenidos en una cuenca siguen una tendencia fractal, la cual puede ser parabólica o lineal. El comportamiento de dicha curva representa las reservas encontradas y la tendencia teórica representaría el total del recurso por descubrir bajo condiciones tecnológicas similares de exploración y producción.*

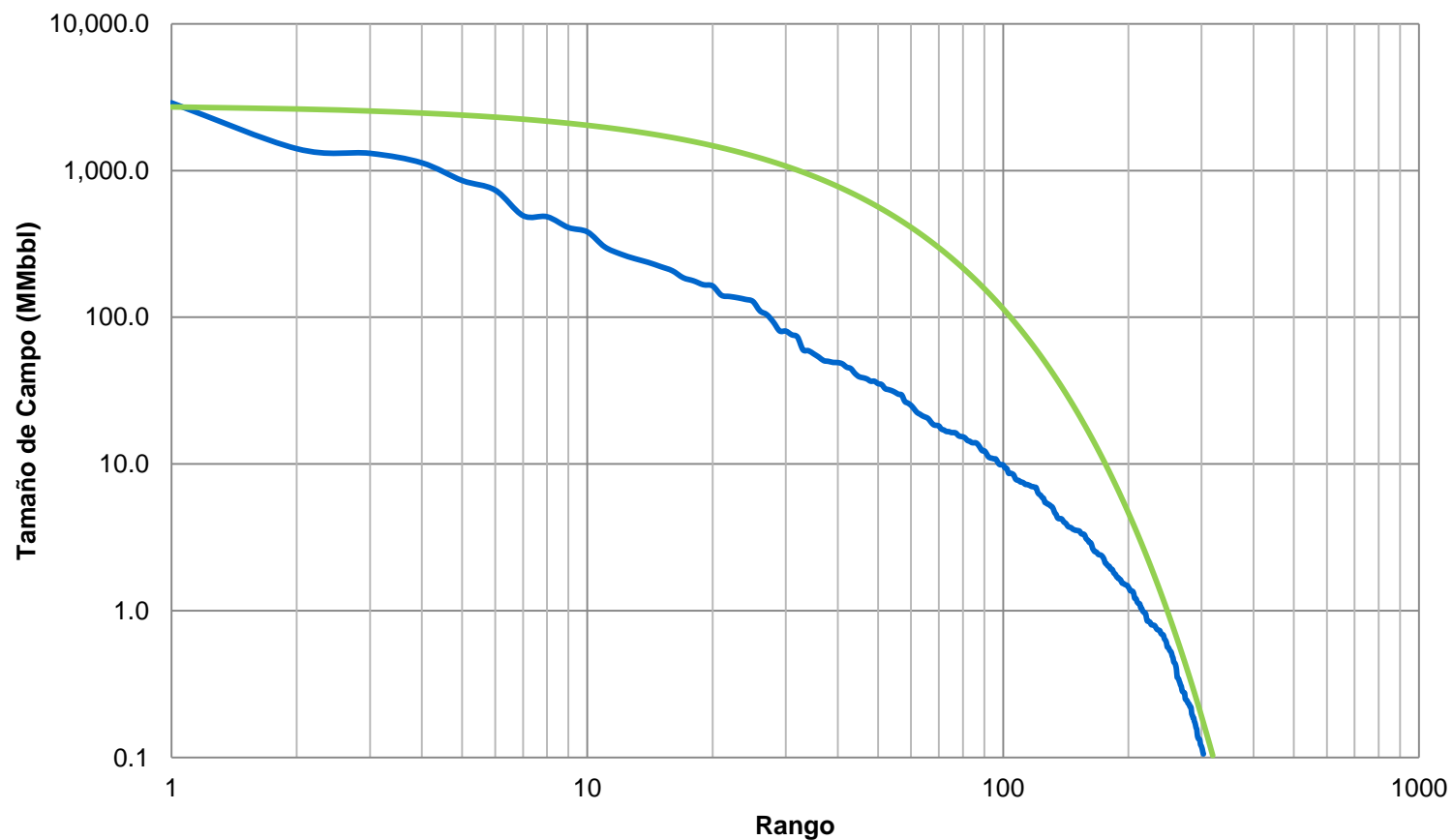


Representación fractal de recursos existentes y por descubrir.



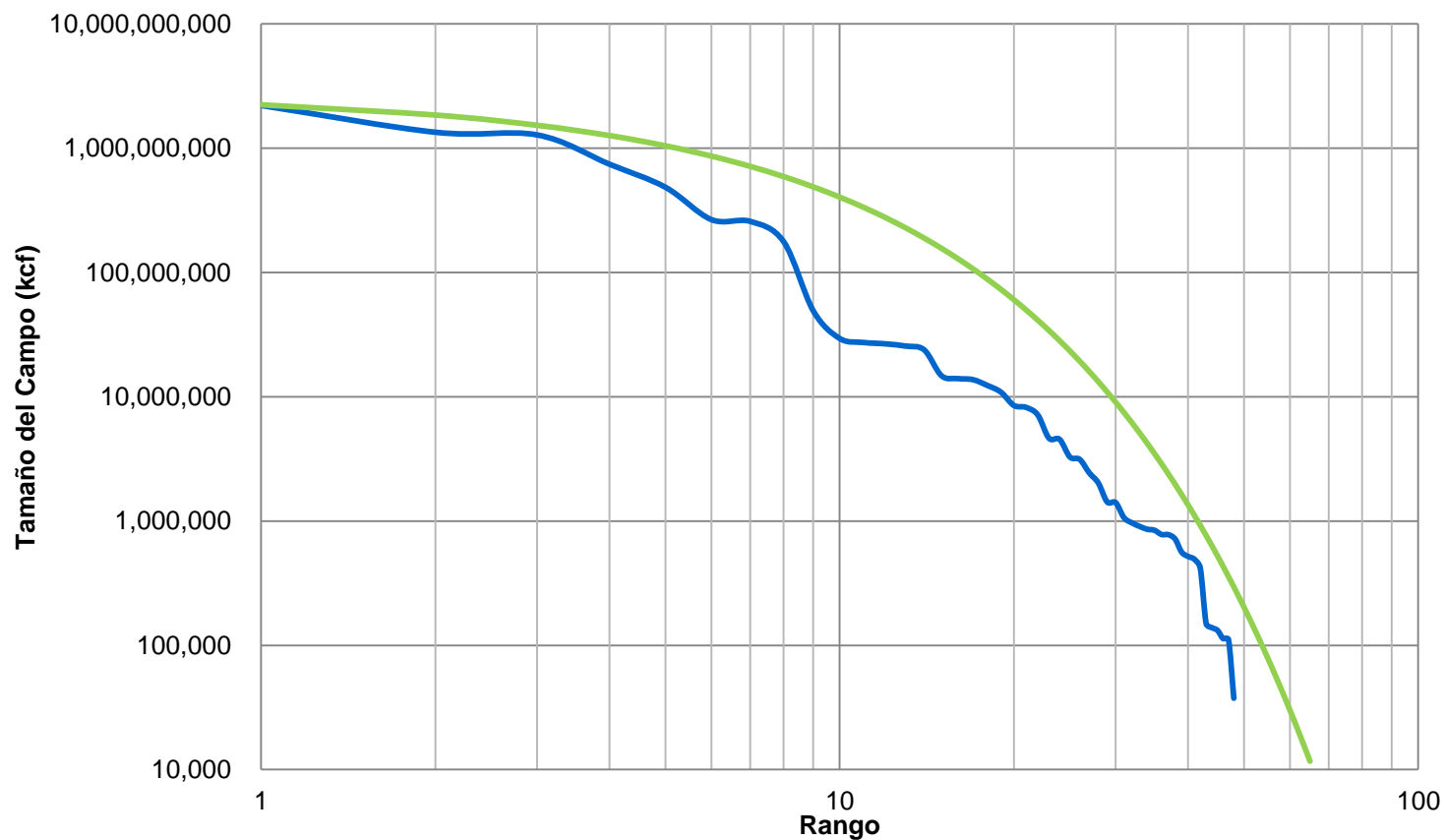
Tamaño de Reservas Categorías (MMbbl)	Reservas Descubiertas		Aún por descubrir	
	MMbbl	Número de campos	MMbbl	Número de campos
< 1.0	24.1	56	61.2	221
≥ 1.0 y < 2.5	52.1	31	15.2	12
≥ 2.5 y < 5.0	71.0	20	3.3	1
≥ 5.0 y < 10	118.9	17	0.0	0
≥ 10 y < 25	113.9	7	80.6	5
≥ 25 y < 50	38.7	1	137.1	4
≥ 50 y < 100	110.7	2	158.3	2
≥ 100 y < 250	668.3	4	0.0	0
≥ 250 y < 500	409.1	1	0.0	0
≥ 500 y < 1000	0.0	0	622.9	1
≥ 1000 y < 2500	2718.9	2	0.0	0
≥ 2500	0	0	4500.0	1

Producido	Reservas	Por descubrir	YTF + Reservas
3,130 MMbbl	4,325 MMbbl	4,095 MMbbl	8,420 MMbbl



Reservas	Por descubrir	YTF + Reservas
15,800 MMbbl	70,300 MMbbl	86,100 MMbbl





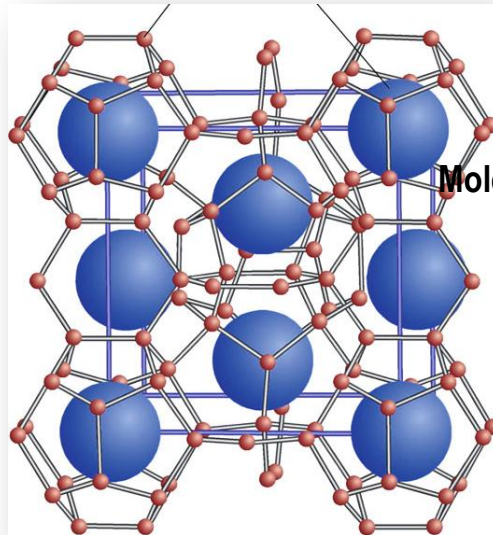
Reservas	Por descubrir	YTF + Reservas
7.06 Tcf	5.85 Tcf	12.91 Tcf

# Potencial de Hidratos de Gas en Colombia

Metano → estructuras de hielo → actividad biológica (medios marinos)

Entrampamiento → presión - temperatura baja

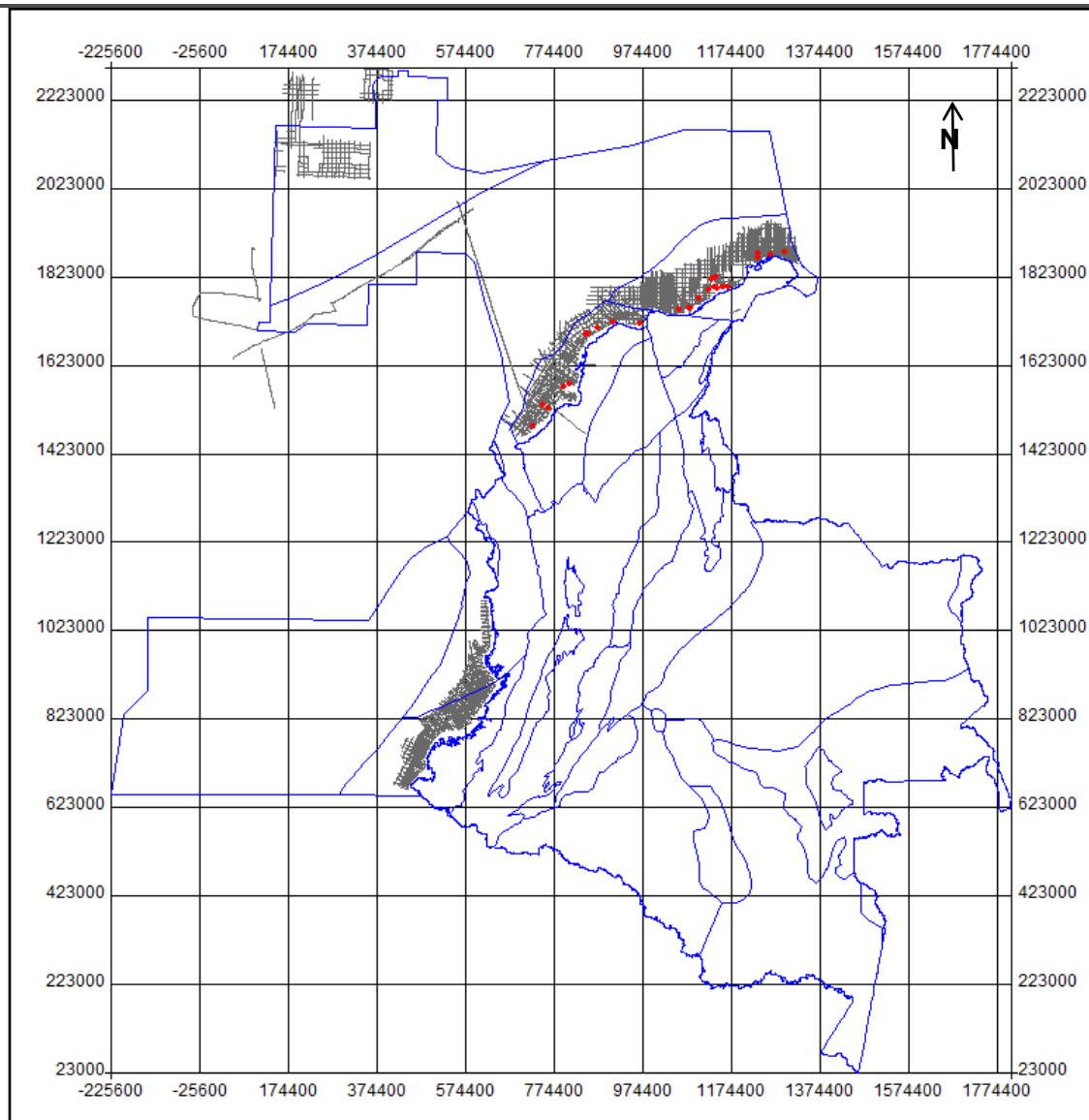
Molécula de agua



Molécula de gas



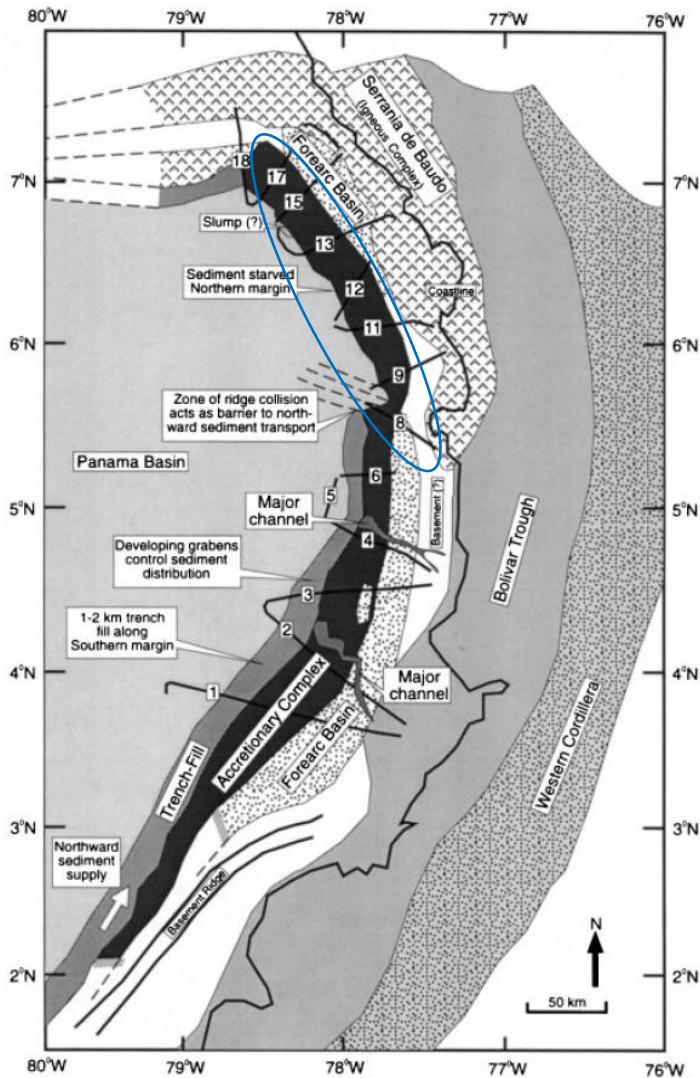
Nature (2009)



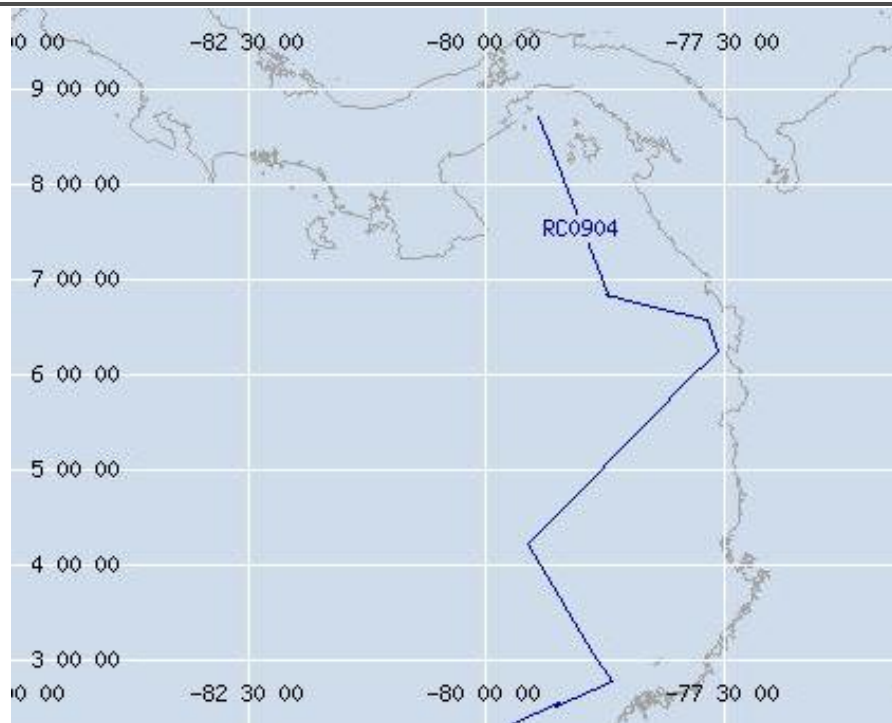
Aprox. 40.000 km sísmica  
28 Pozos

Quantitative analysis of Miocene to recent forearc basin evolution along the Colombian convergent margin

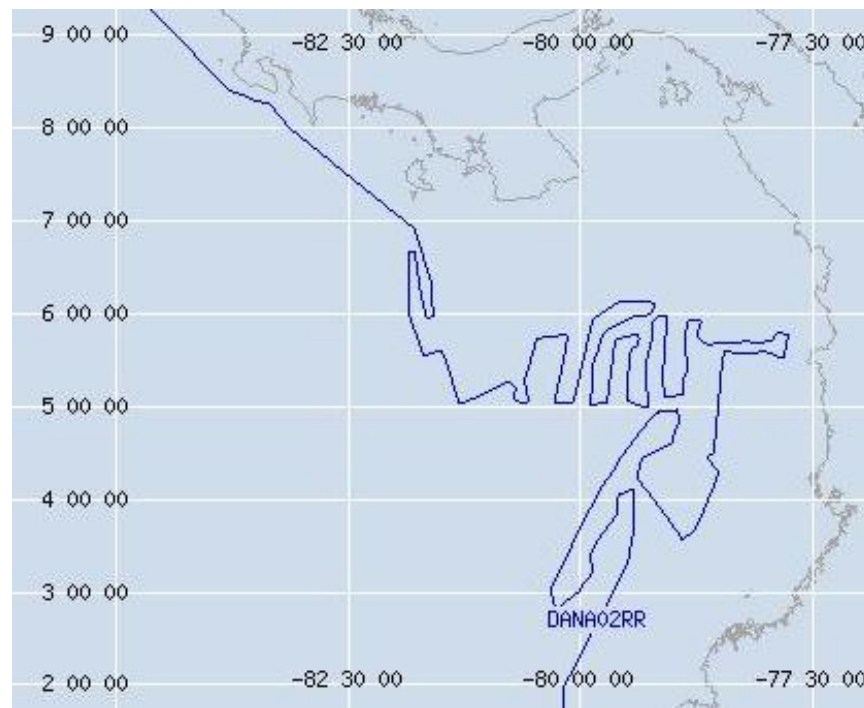
*Mountney & Westbrook, (1997)*



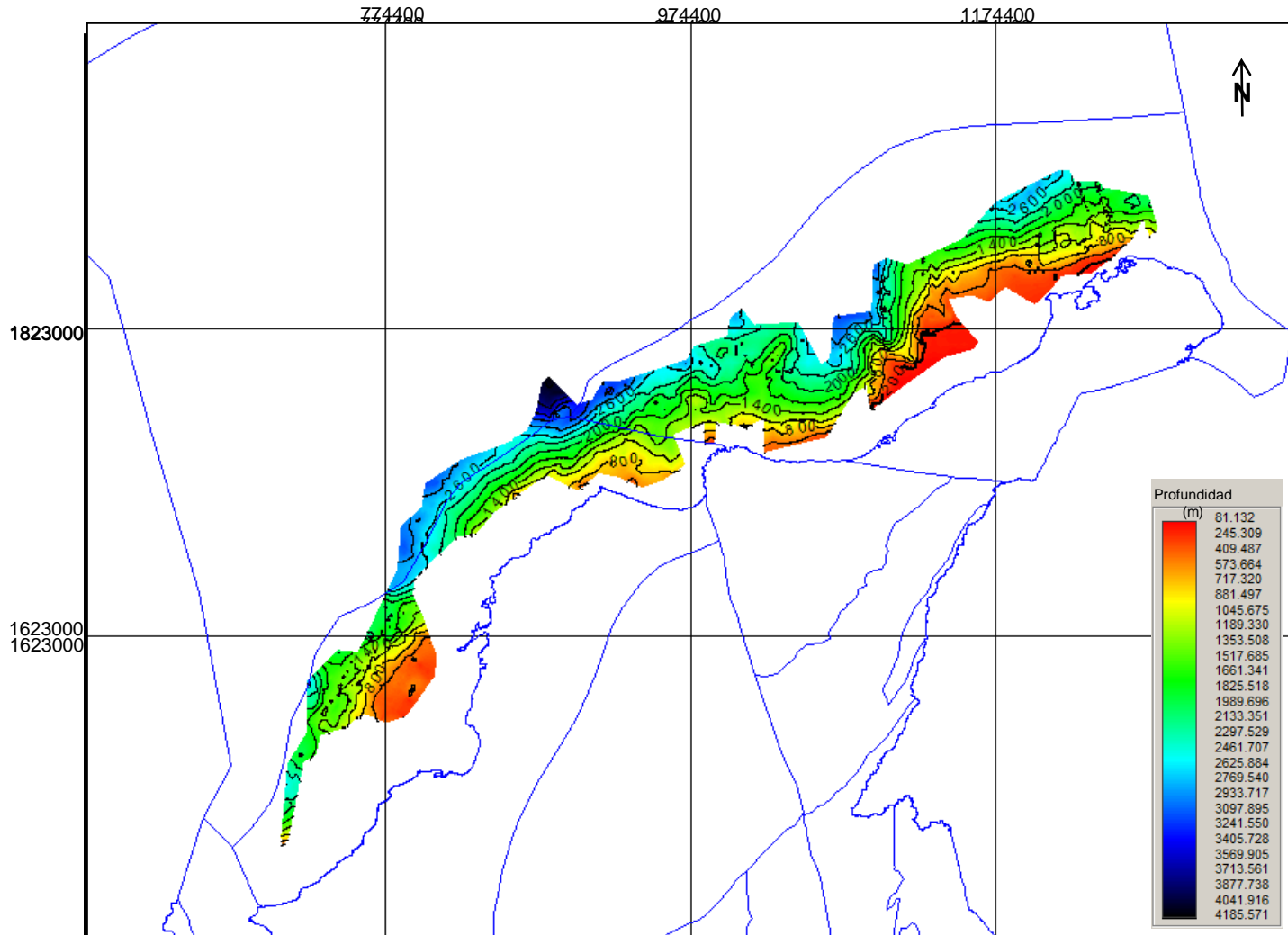
CD40 en 1989.  
Modificado de Mountney & Westbrook, (1997)



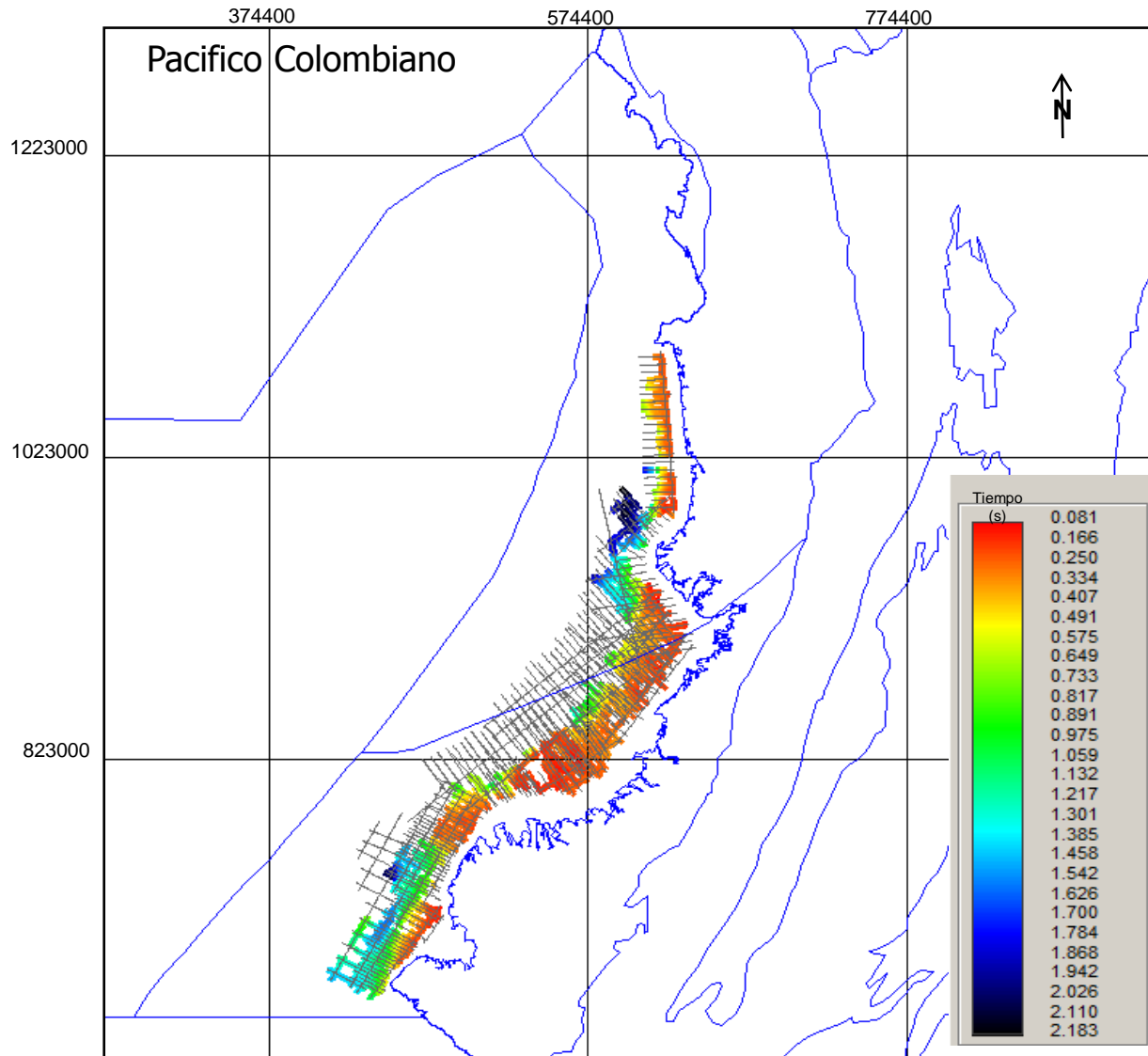
RC0904 – (líneas sísmicas)



DANA02RR (líneas sísmicas)

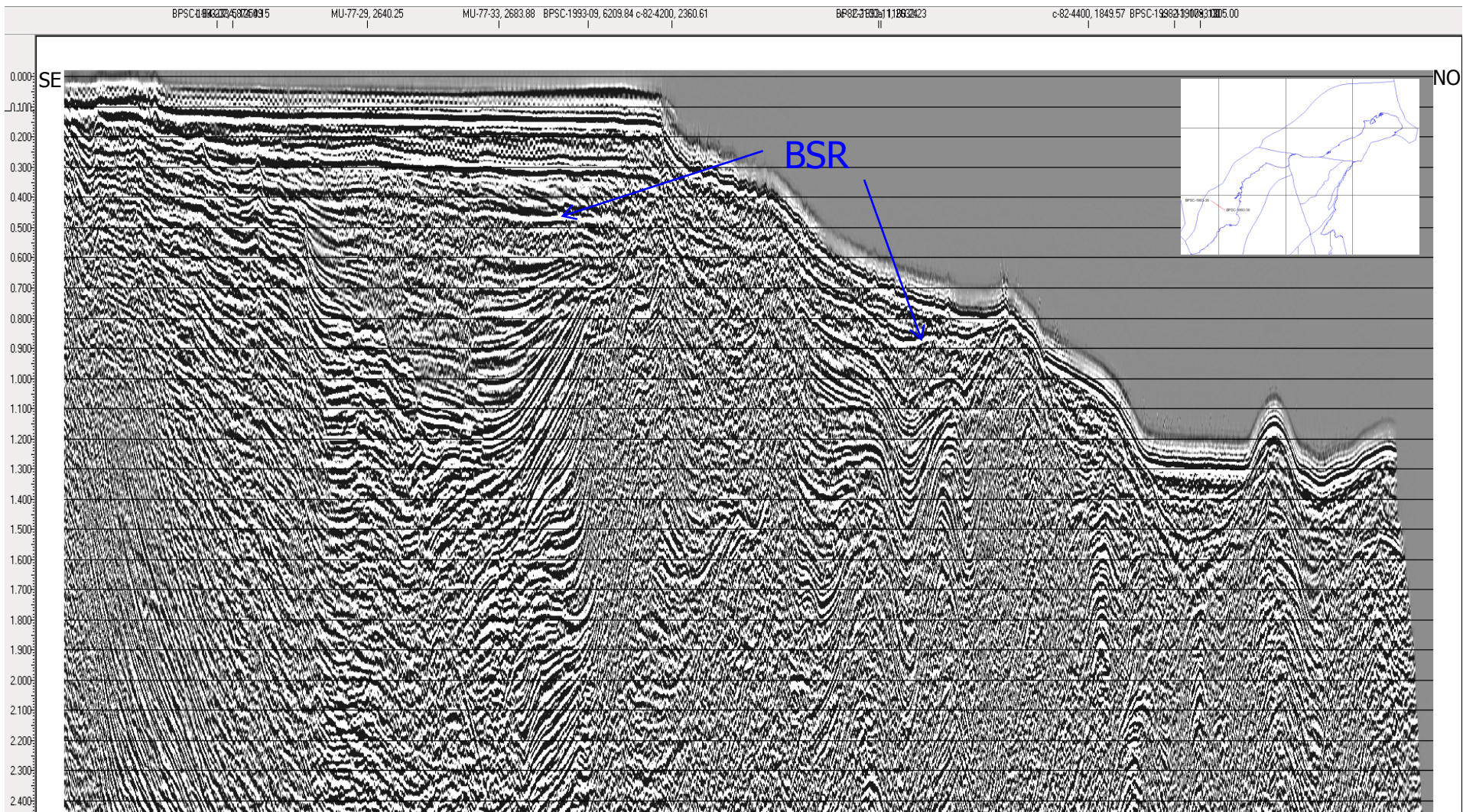


# BSR Pacifico



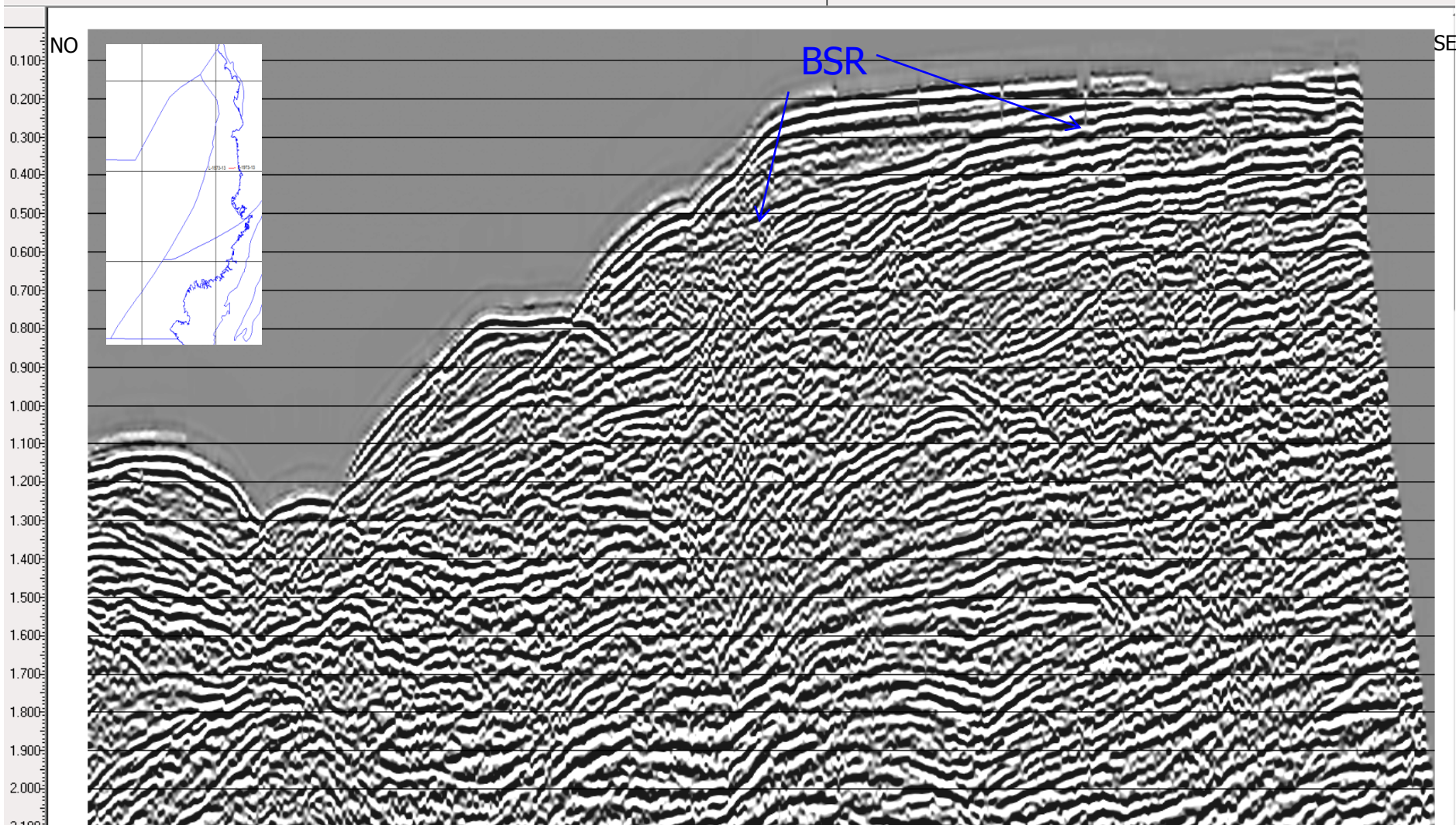


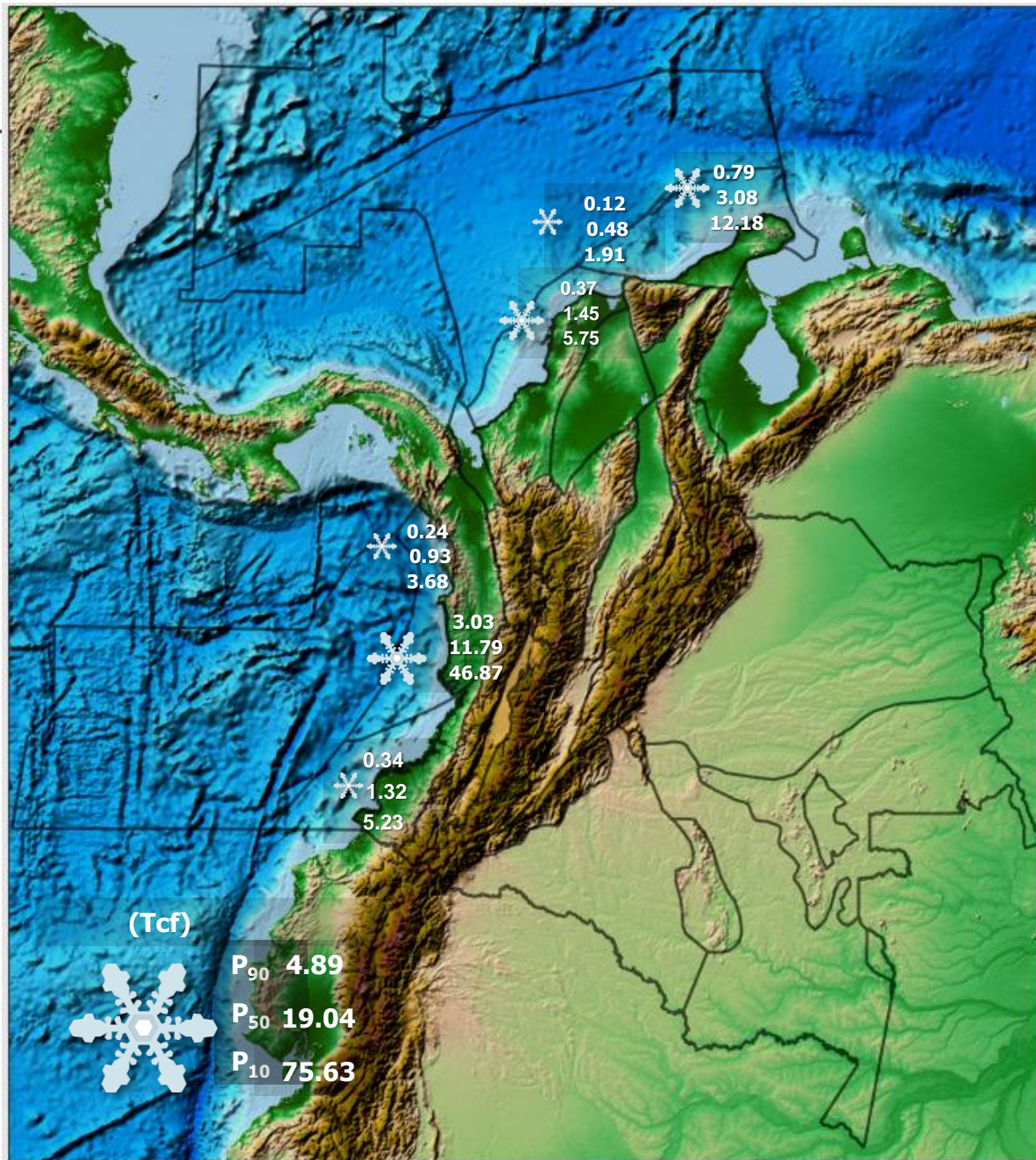
BPSC-1993-36



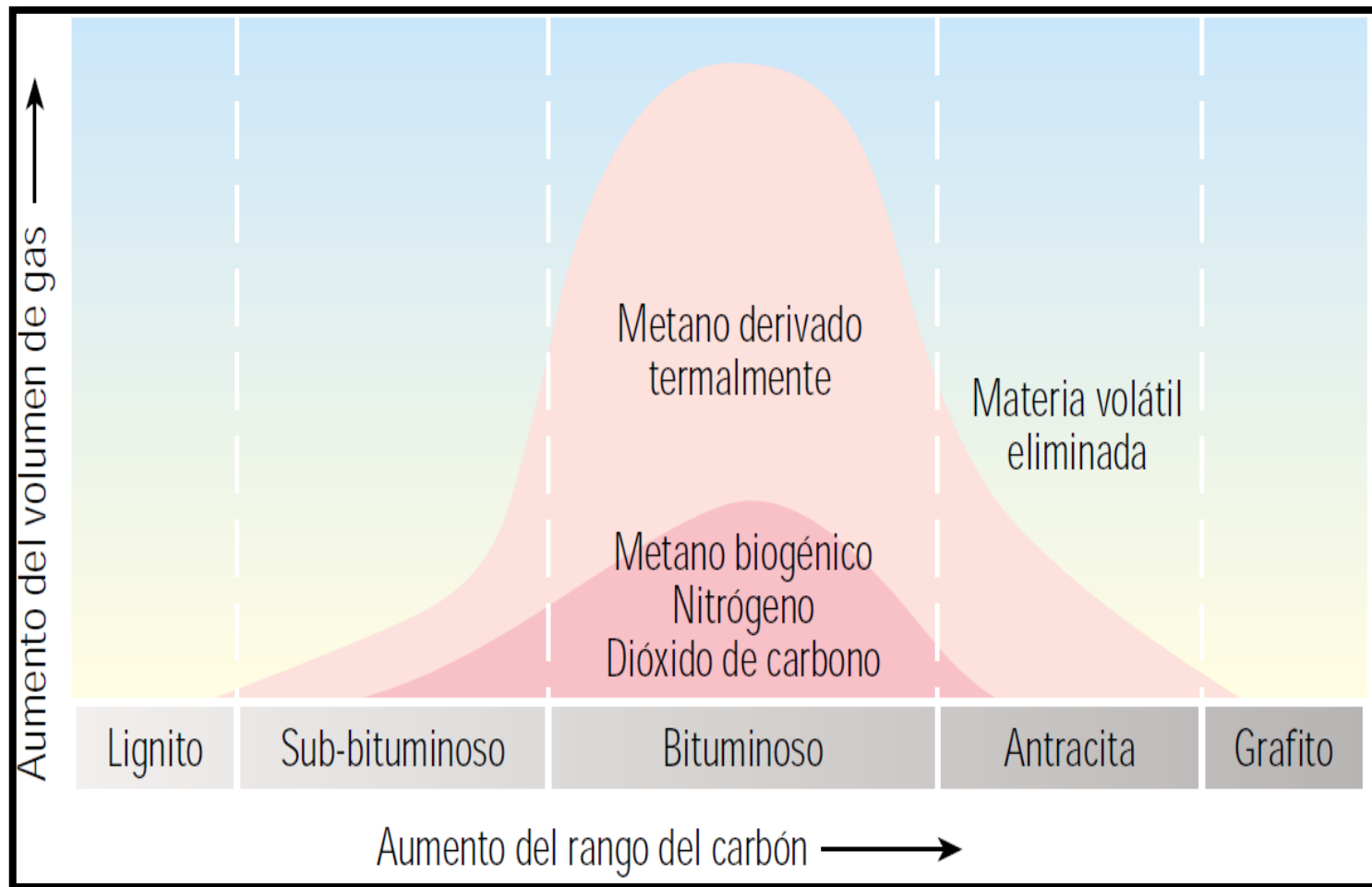
L-1973-13

L-1973-D5, 846.56

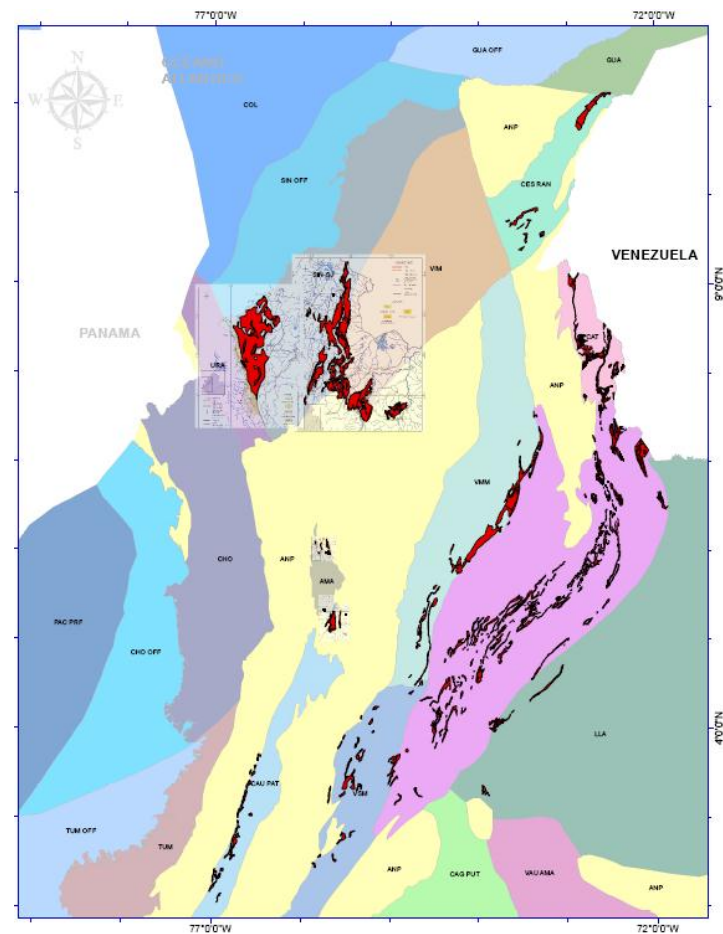
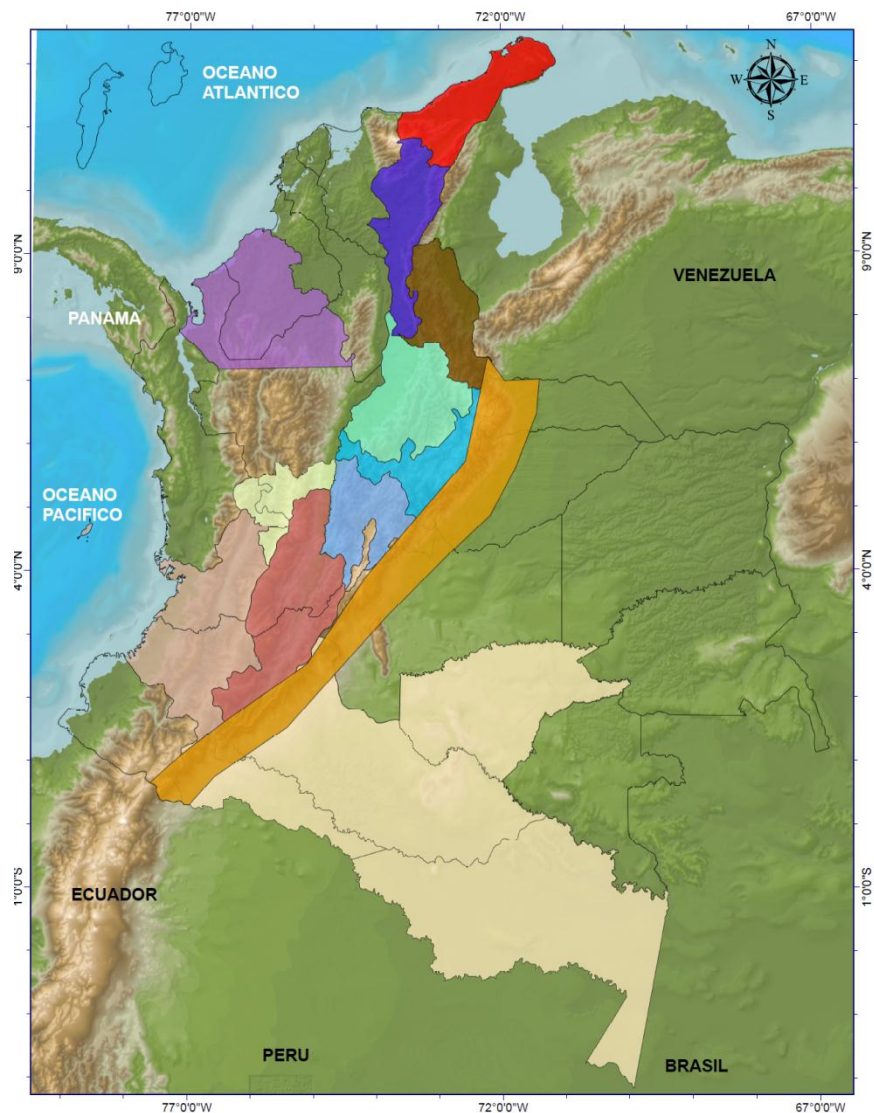


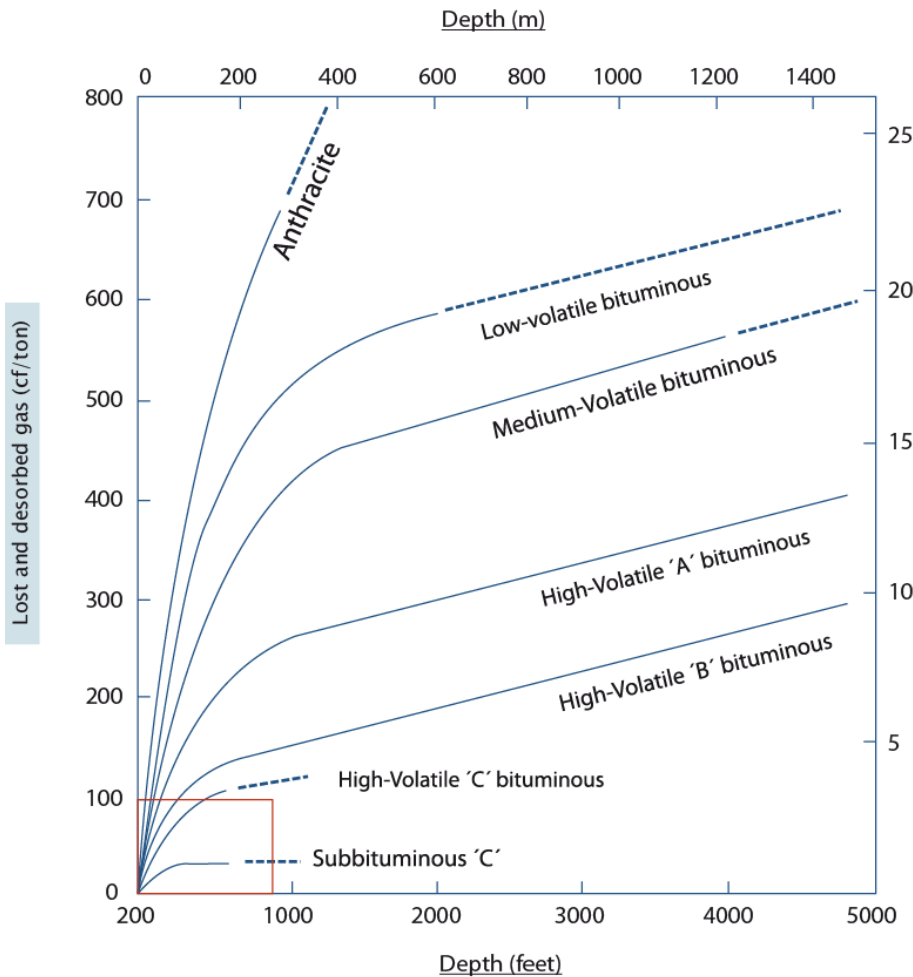


# Potencial de Gas asociado a Carbón en Colombia



Schlumberger (2003/2004)





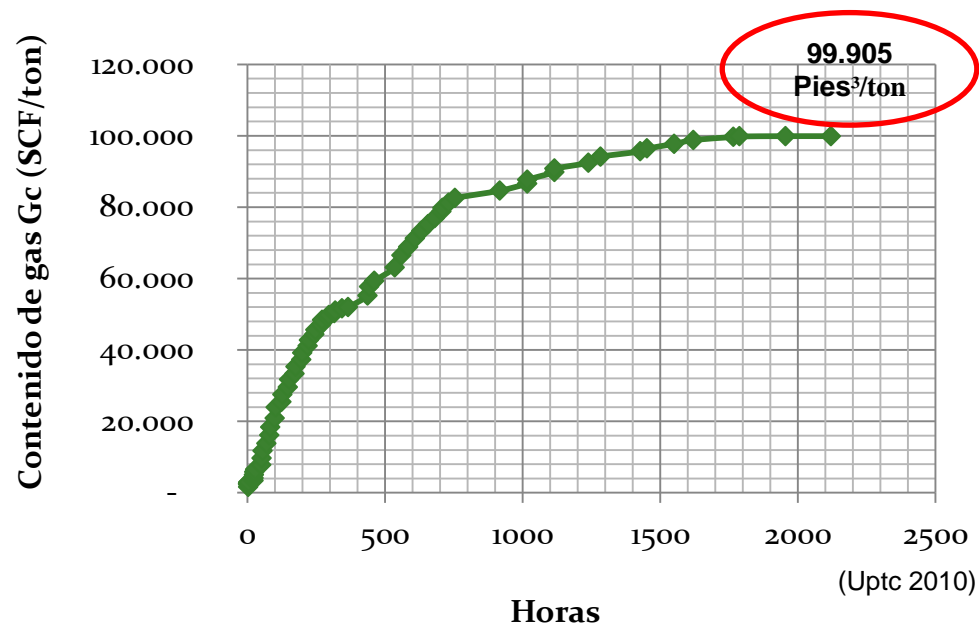
(Eddy 1982)

Coal rank	Reflectance (%)	Volatile matter (%)	Carbon (% dry ash-free, vitrinite)	Bed moisture (%)
Peat		64	60	75
Lignite	0.3	60		
Sub bituminous C		56		35
		52		
	0.4			
High-volatile bituminous A	0.5	48	71	25
	0.6	44	77	8-10
High-volatile bituminous B	0.7	40		
	0.8			
High-volatile bituminous A		36		
	1.0	32		
Medium-volatile bituminous	1.2	28	87	
	1.4	24		
Low-volatile bituminous	1.6	20		
	1.8	16		
Semi-anthracite	2.0	12		
		8	91	
Anthracite	3.0			
	4.0	4		

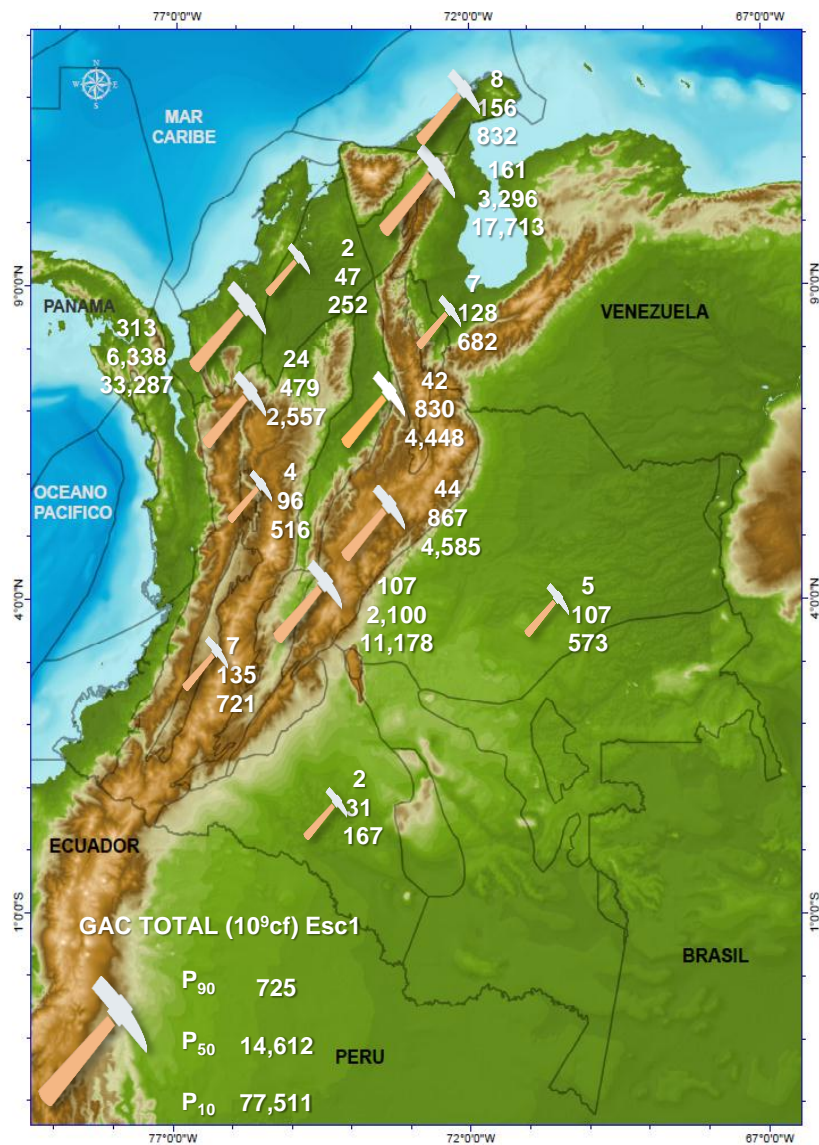
(Stach, 1982)

Permeabilidad	0.5 – 50.0mD
Porosidad	5 – 12 %
Rango de Carbón	Bituminoso alto en volátiles B – Sub-bituminoso A
Espesor de carbón x manto	30 cm – 2 m
Espesor neto	6 – 8 m
Valor $G_c$ esperado	60-100 <i>pies</i> <sup>3</sup> /ton

**CURVA DE DESORCION SECTOR LA CHAPA - BOYACÁ**

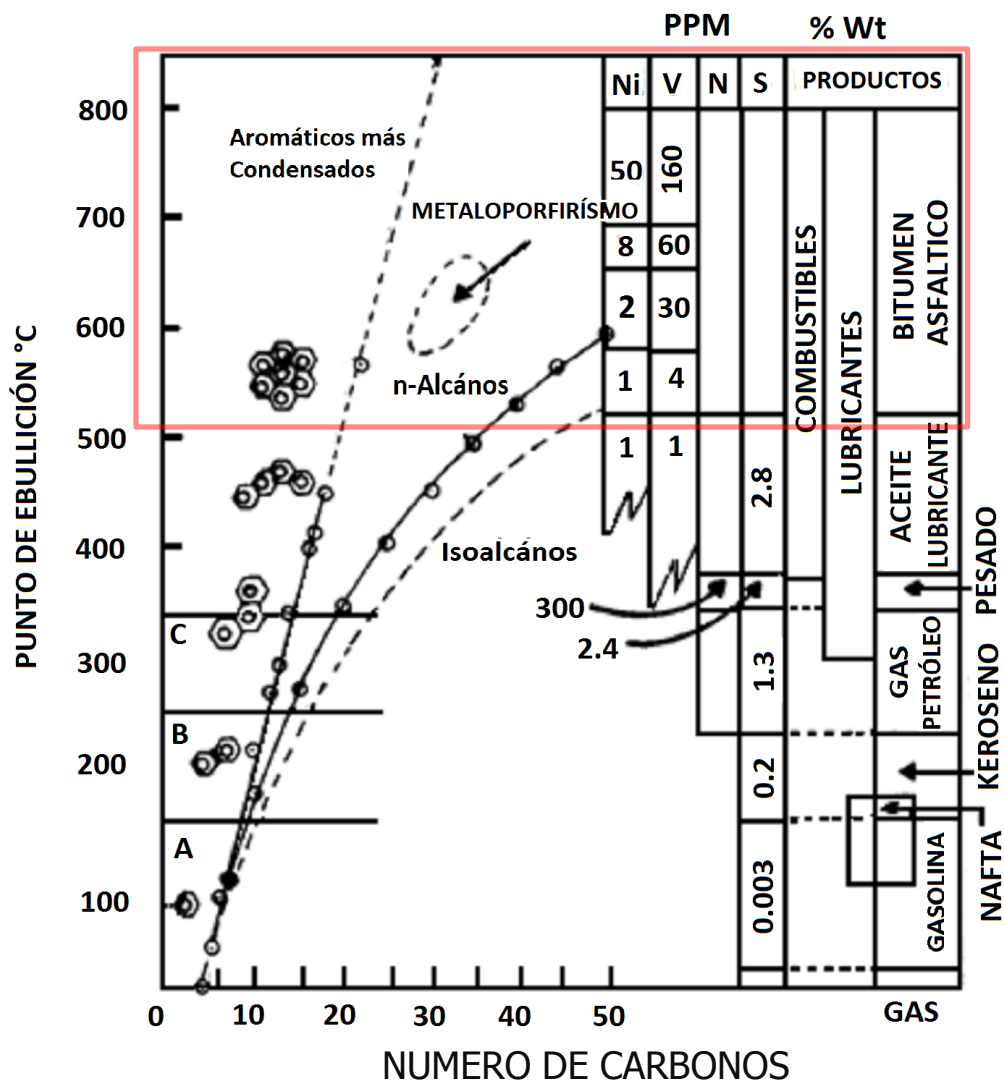









# Potencial de Arenas Asfálticas en Colombia

# Tar sands (oil sands)

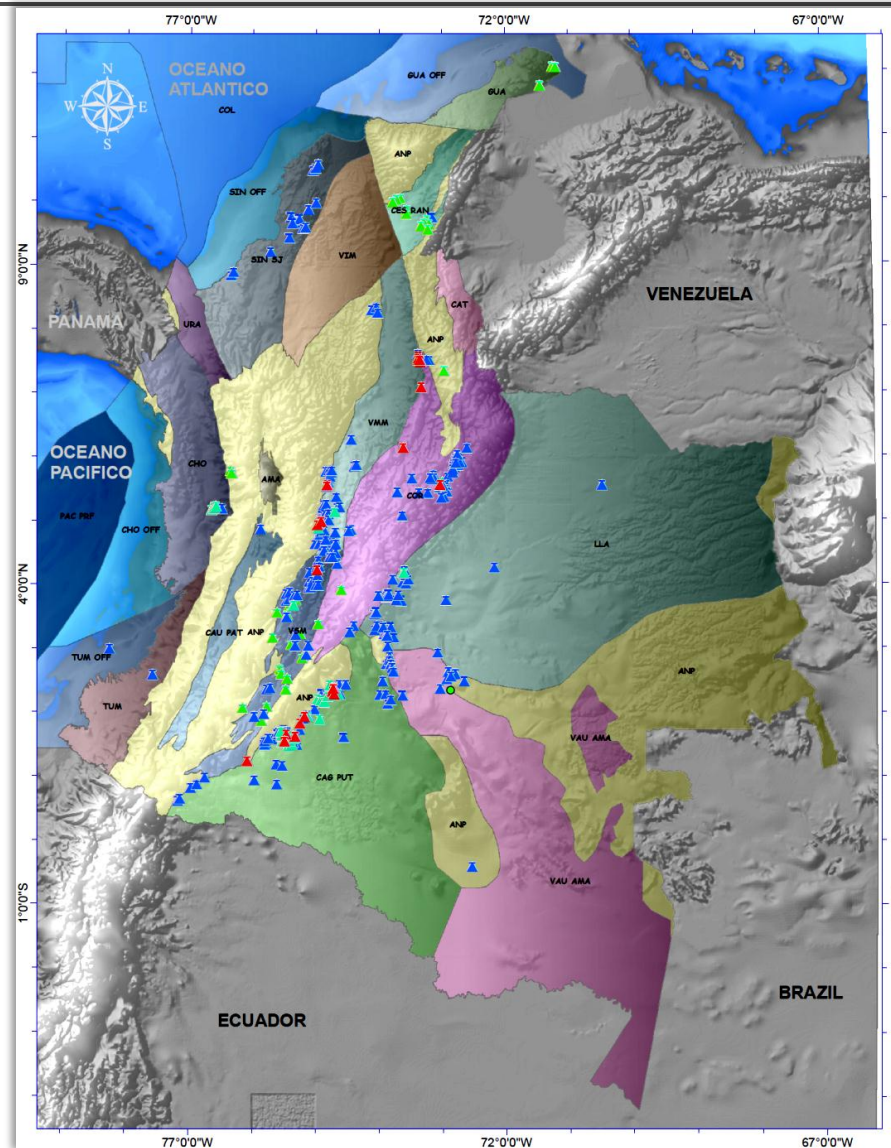


[www.banktrack.org](http://www.banktrack.org)

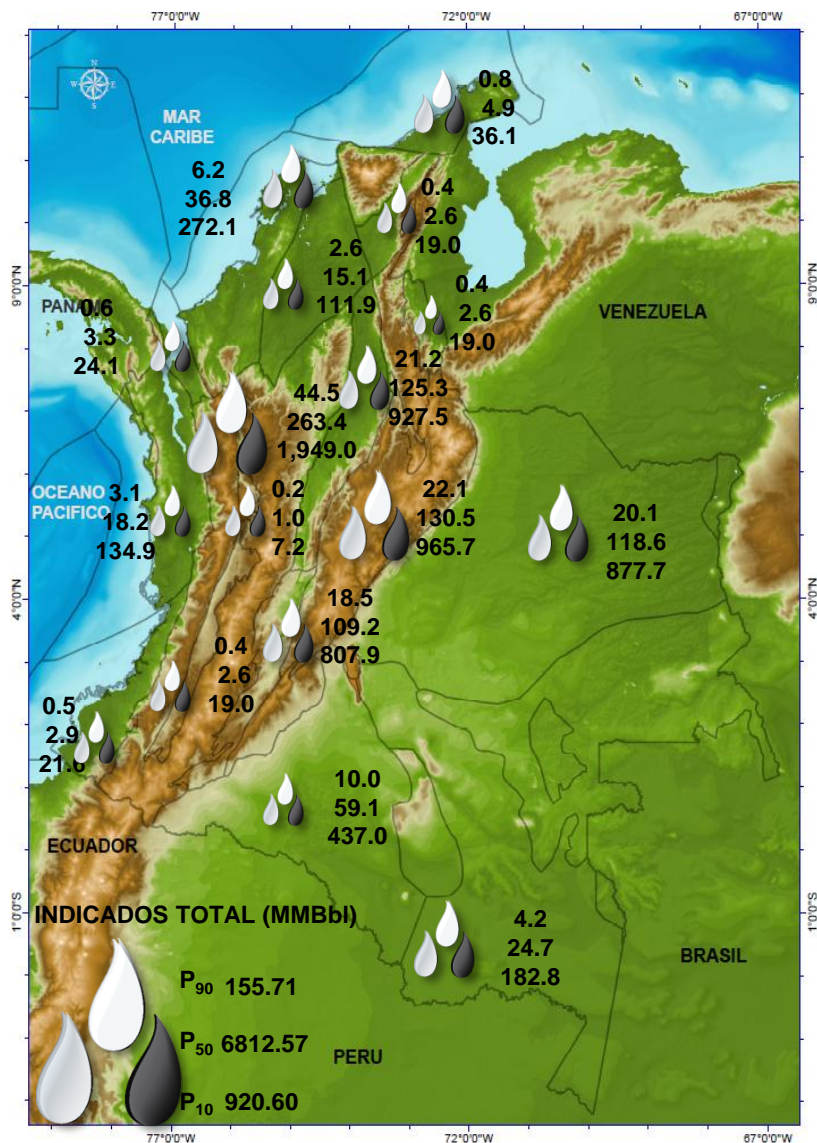
eyevine

-  ATLAS GEOQUÍMICO ANH
-  TITULOS Y SOLICITUDES MINEROS - INGEOMINAS
-  Otros estudios INGEOMINAS - Universidades

## Hipótesis 1



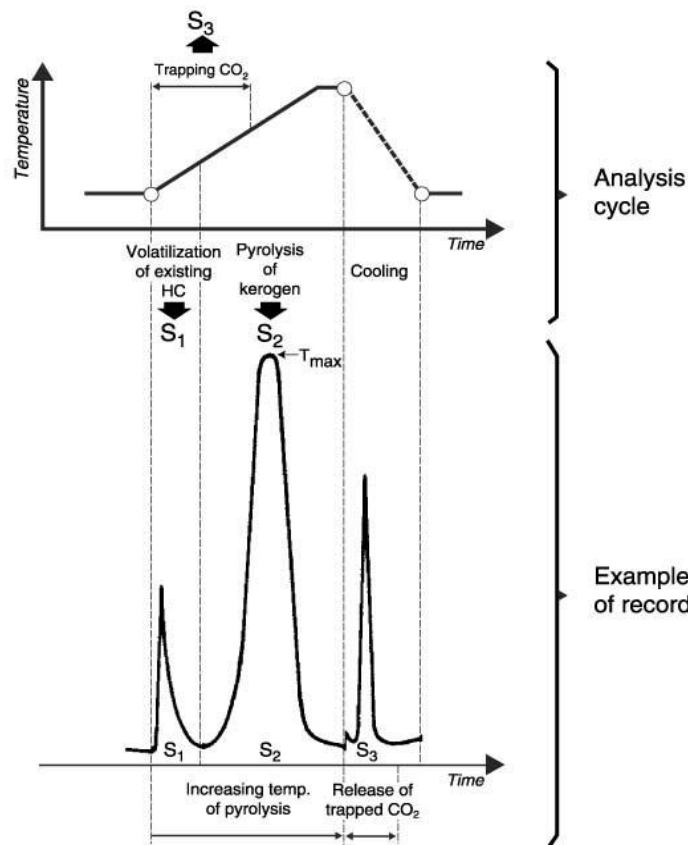
# Recursos Indicados



# Potencial de Petróleo de Shales en Colombia

El término «*oil shale*» se refiere a cualquier roca sedimentaria que contiene materiales Bituminosos solidos (kerogeno) y que puede ser liberado como hidrocarburos líquidos cuando la roca es calentada en un proceso químico llamado pirolisis.





Oil or gas shows  
S<sub>1</sub> (g/ton of rock)

Oil and gas potential  
Generic potential  
S<sub>1</sub>+S<sub>2</sub> (kg/ton of rock)

Type of org. matter  
S<sub>2</sub>/org C Hydrogen index  
S<sub>3</sub>/org C Oxygen index

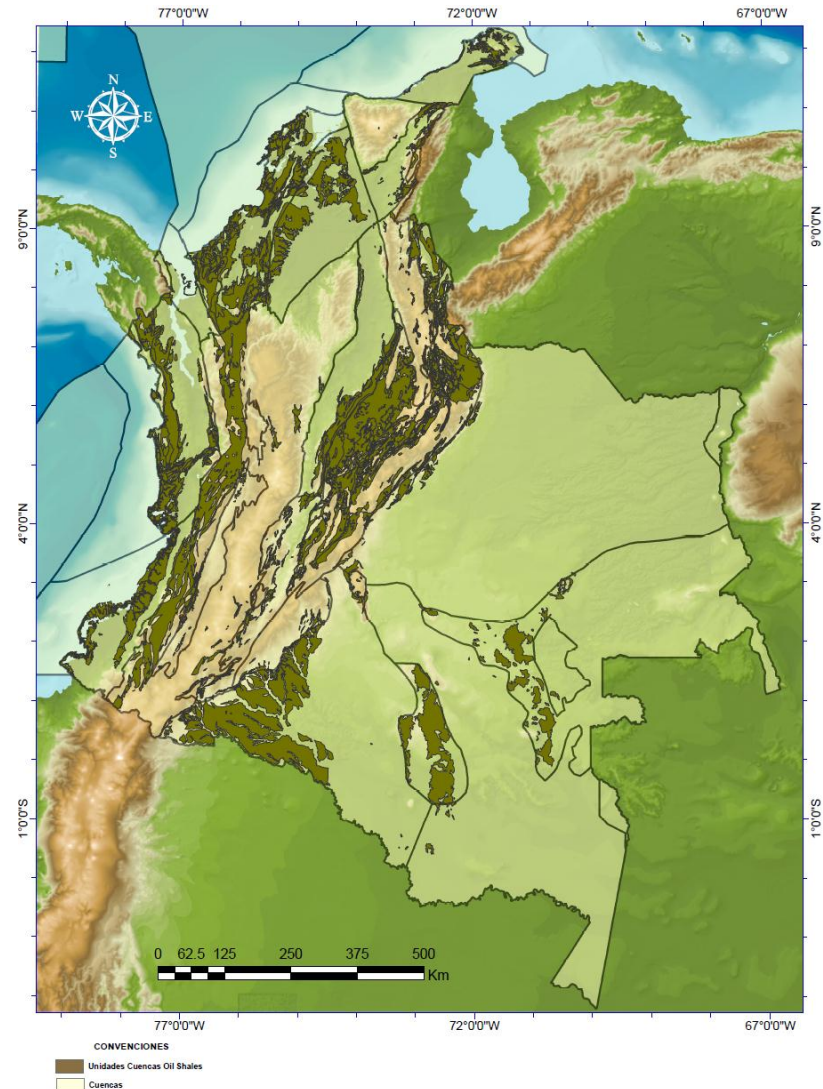
Maturation  
Transformation ratio  
S<sub>1</sub>/S<sub>1</sub>+S<sub>2</sub>  
Peak temperature T<sub>max</sub><sup>o</sup>(C)

Application to petroleum exploration

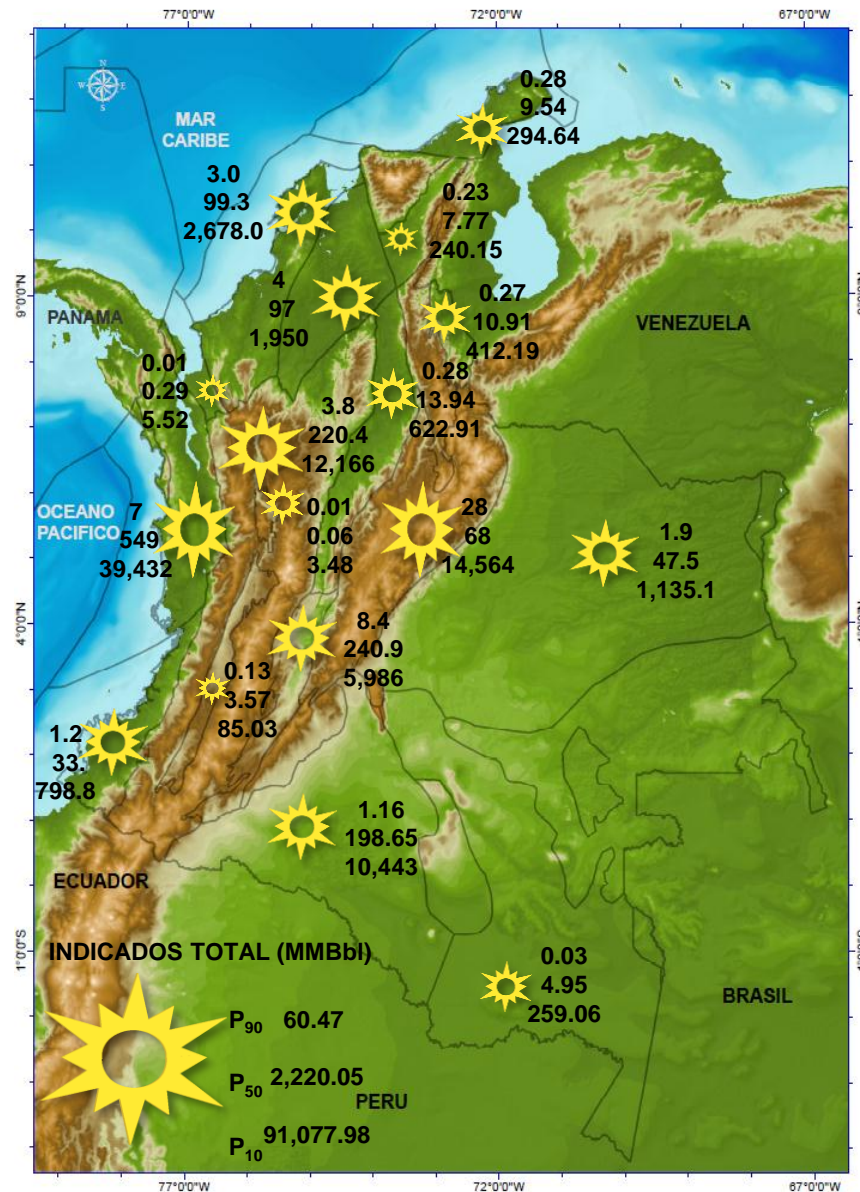


En Colombia la presencia de Oil Shale se restringe principalmente a rocas del Mesozoico tardío y Cenozoico:

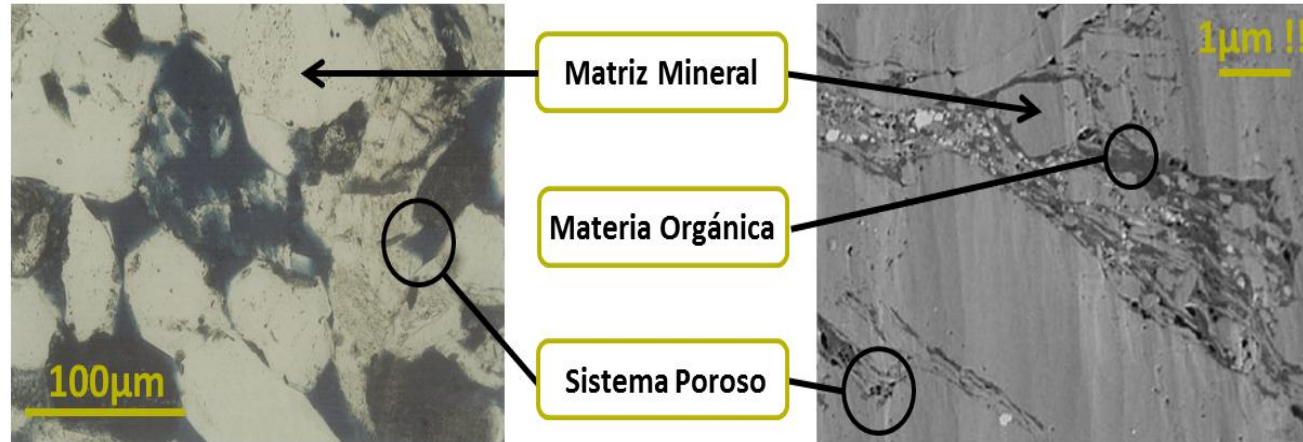
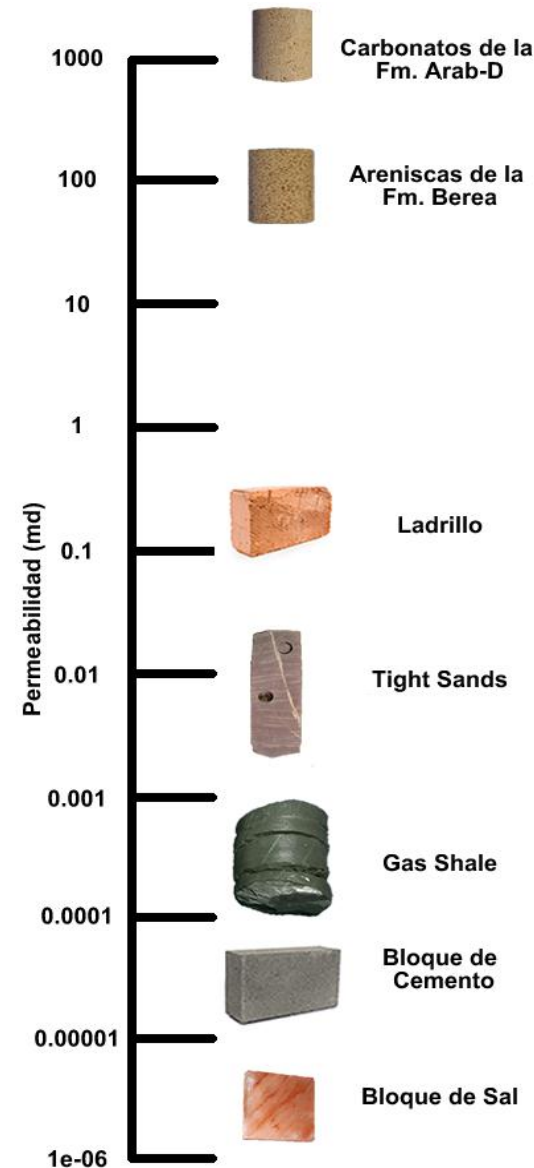
- Cartografía Geológica (INGEOMINAS, 2007)
  - Shales, lodolitas y lodos con materia orgánica.
- Atlas Geoquímico (ANH, 2010)
  - Pruebas de Pirolisis y TOC.



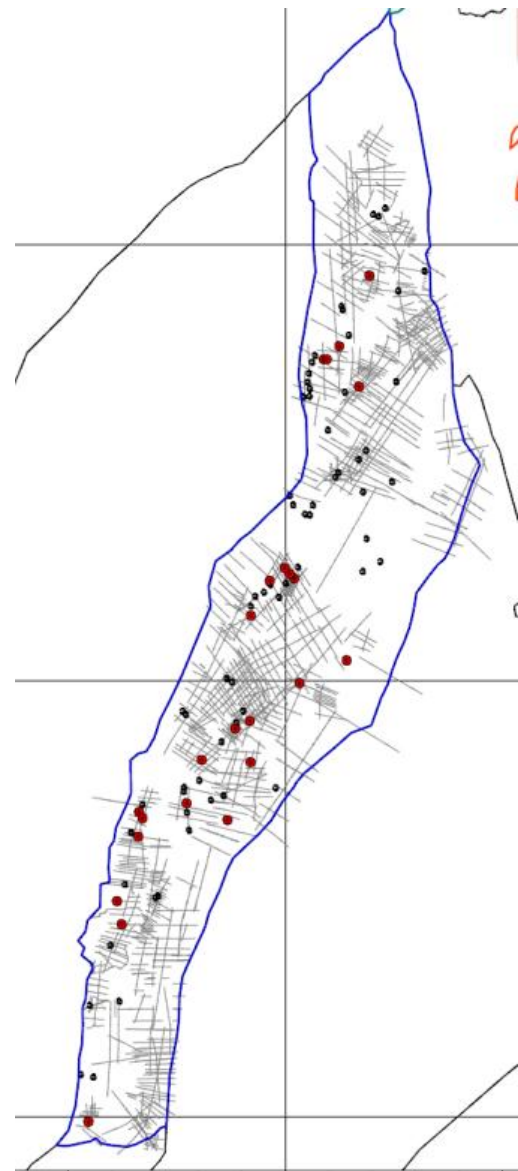
# Shale Oil - Recursos indicados Esc1



# Potencial de Shale Gas

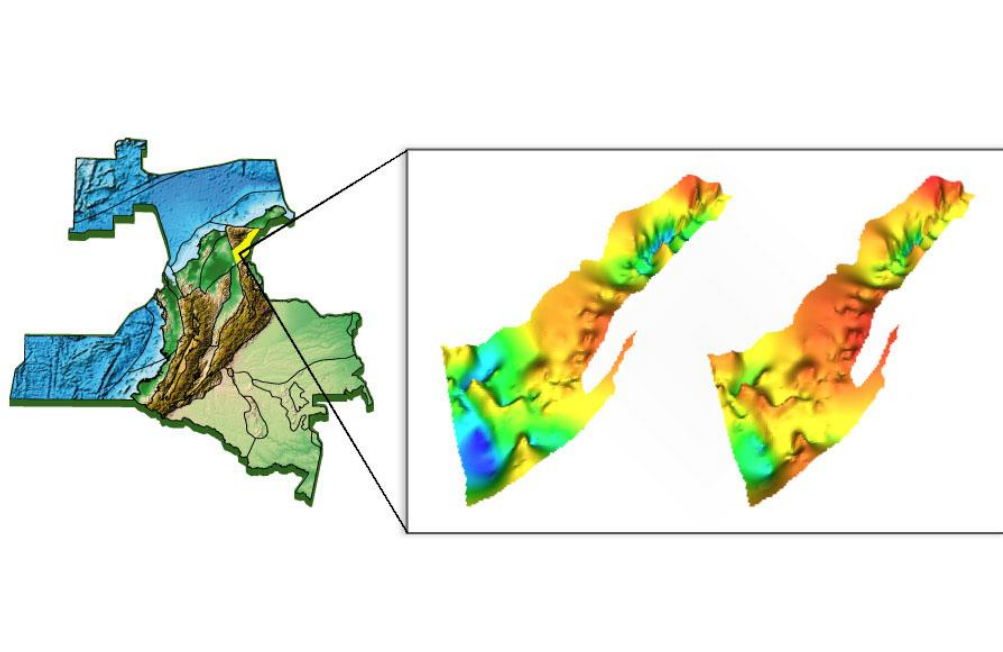
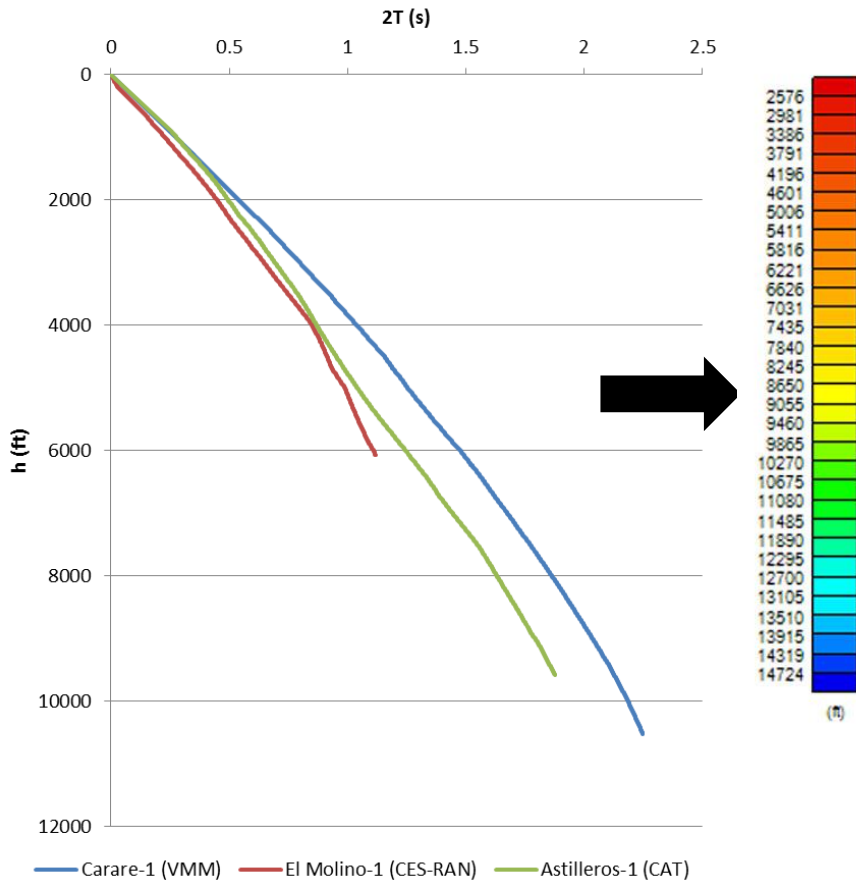


- Gran extensión areal.
- HC independientes de los WOC-GOC.
- Carecen de sello o trampa.
- Asociadas con rocas fuente.
- Alto contenido de arcillas (ilita, caolinita, esmectita y clorita).
- Presencia de hidrocarburos en todo el cinturón.

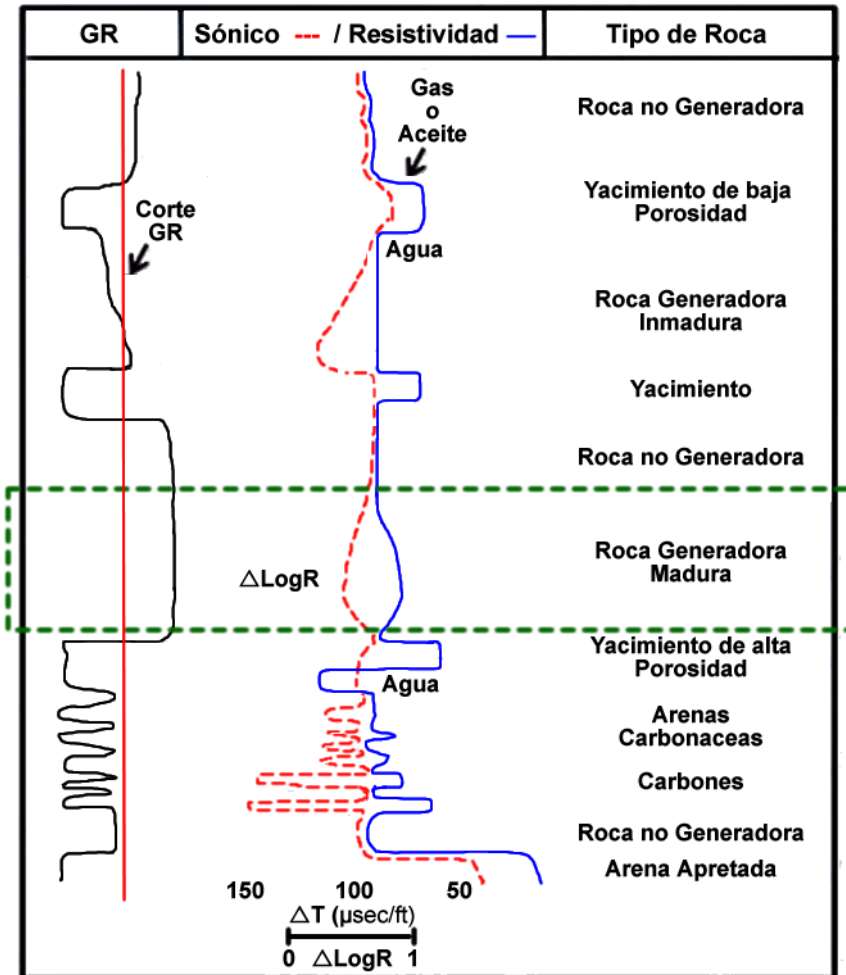


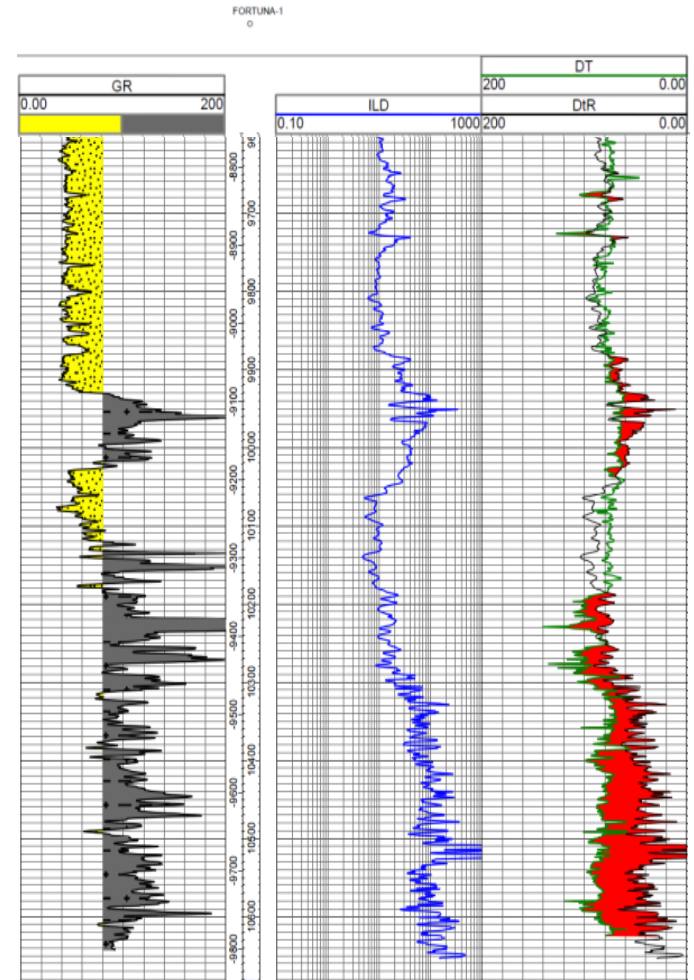
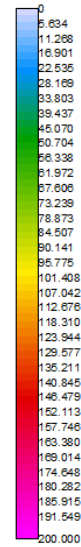
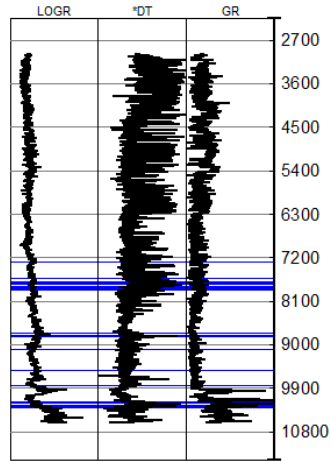
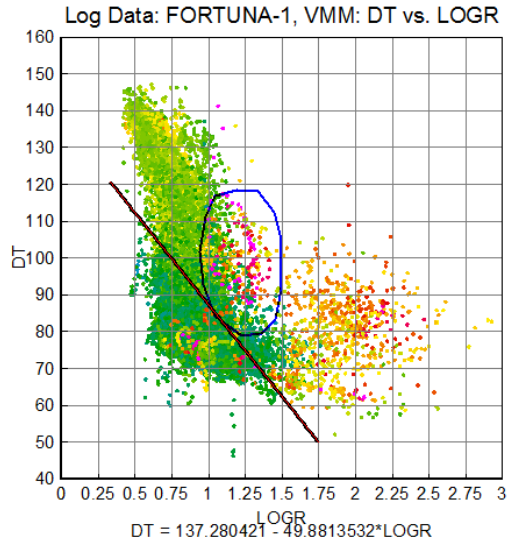
- 1001 Líneas cargadas
- 90% interpretadas y amarradas (Datum 0m)
- 119 pozos cargados y revisados
- 37 pozos analizados (NTG)
- 49 curvas T-Z cargadas (mapas de velocidad).

## Curvas Tiempo - Profundidad



- **Net to Gross** (Passey, 1990)
  - Crossplot DT vs LogR
  - Determinación de la línea de Shale
  - Cálculo de la curva DtR (pseudo-sónica)
  - Definición del cut off del GR (zona de arcillas)
  - **Identificación del cruce entre el DT y el DtR** (GR > cut off)



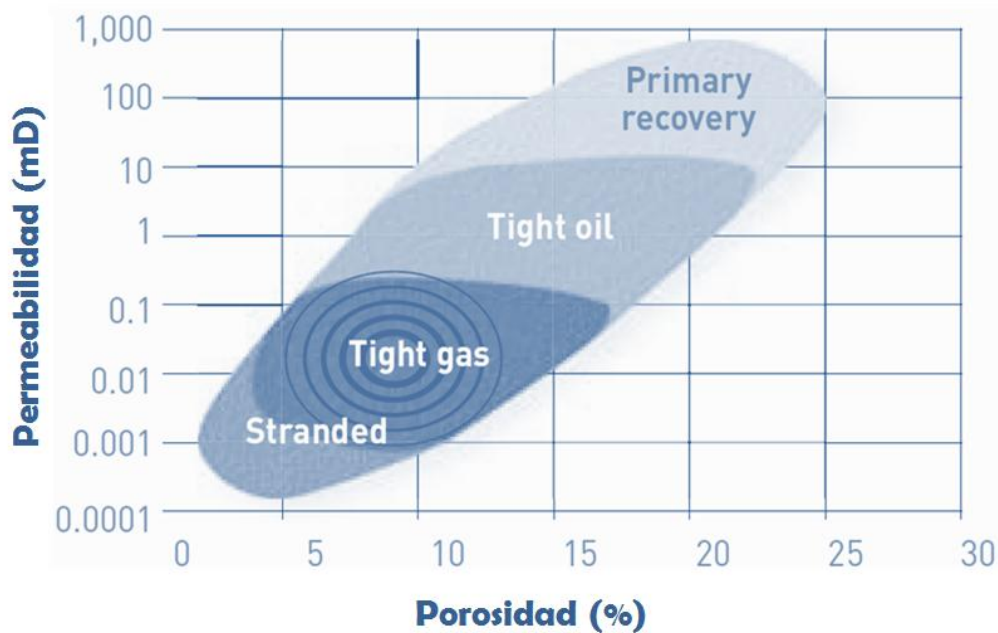




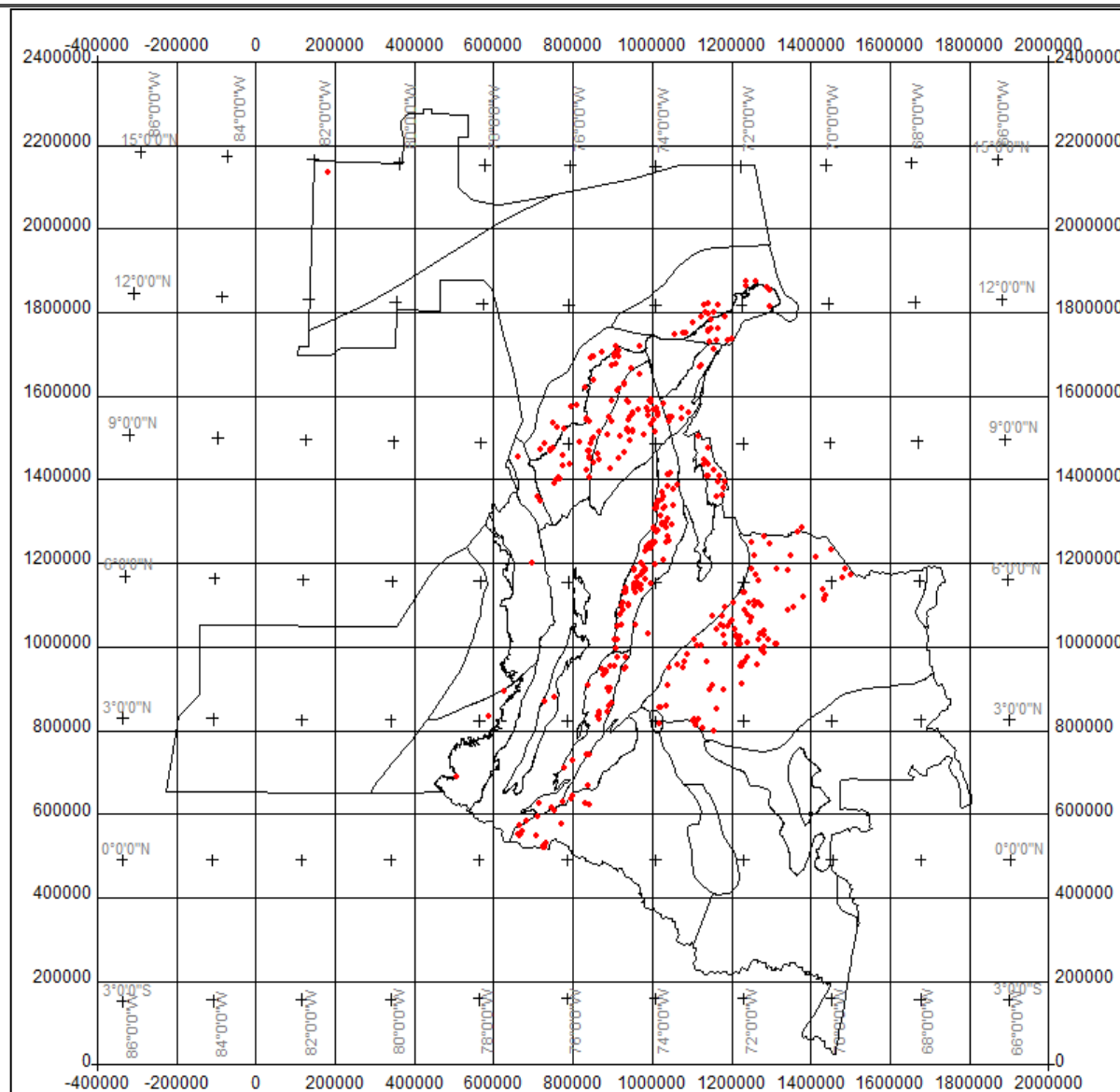
# Shale Gas en Colombia



# Potencial de Gas en arenas apretadas en Colombia



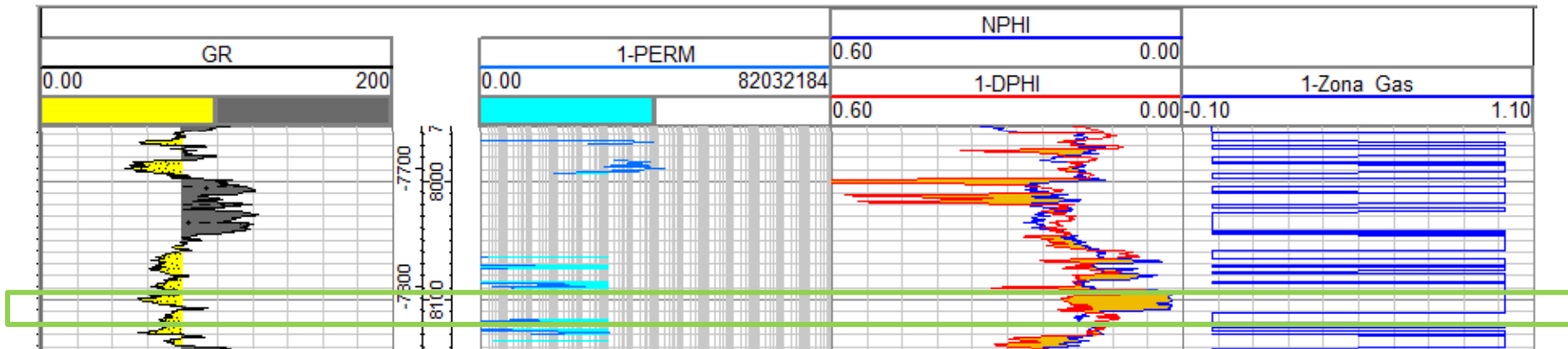
Rangos de porosidad y permeabilidad para los reservorios de gas en arenas apretadas. Modificado de (TOTAL, 2007)



En el mapa se observan los 435 pozos (puntos rojos) para los cuales se cargaron registros.

# Cálculo de volumen de gas en arenas apretadas

$\text{Gamma ray} < \text{Corte}_{\text{gamma ray arena}} \rightarrow \text{Determina si es zona de arena}$   
 $\text{Permeabilidad} < 0.1 \text{ mD} \rightarrow \text{Determina si es una zona apretada}$   
 $0.5 < \text{Zona}_{\text{Gas}} < 1.5 \rightarrow \text{Determina si hay presencia de gas}$



Registros del pozo Montoyas A-1.

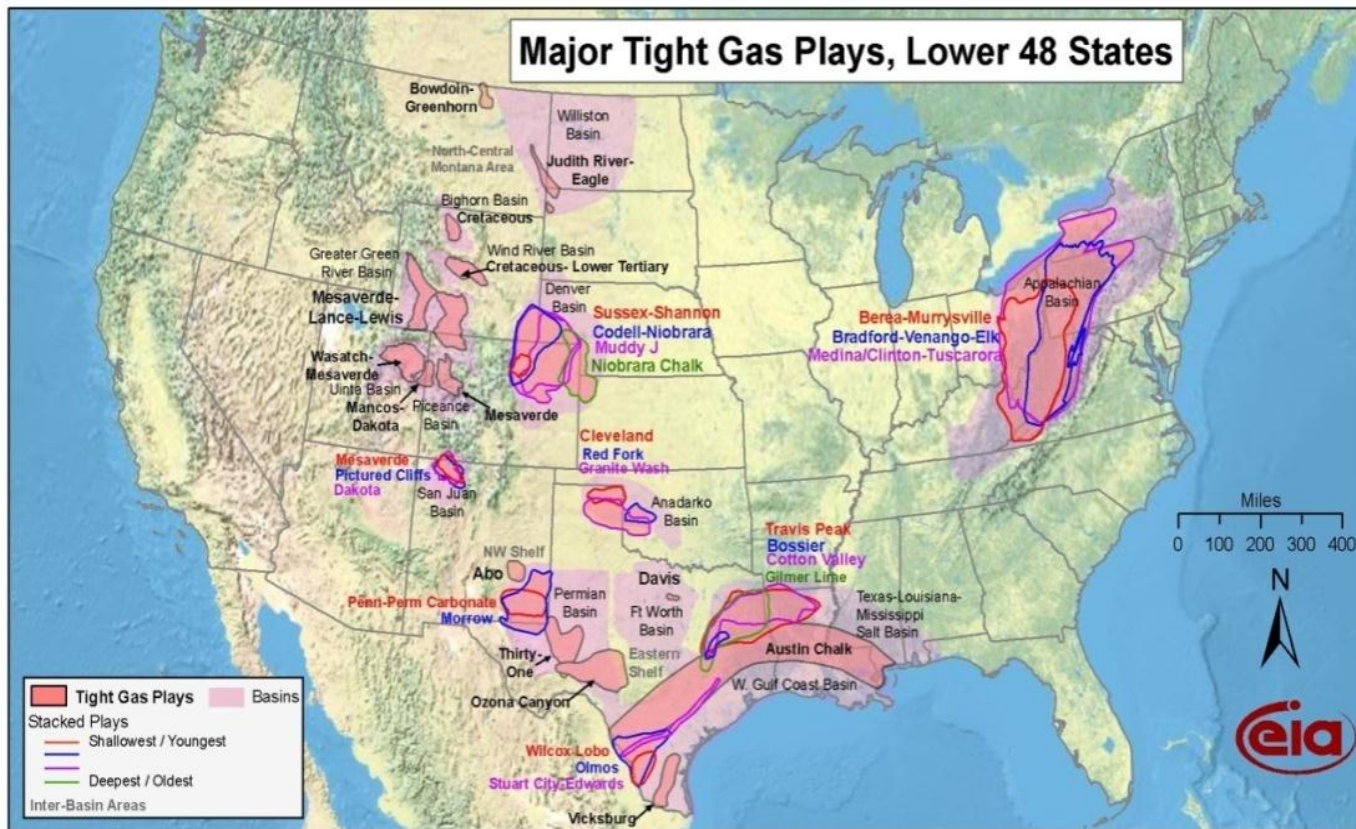
Pista 1 gamma ray, las zonas amarillas corresponden a arenas (Corte de arena 80 API)

Pista 2 permeabilidad resaltadas en azul claro las zonas apretadas (Permeabilidad < 0.1 mD)

Pista 3 porosidad neutrónica (azul) y porosidad por densidad (rojo) en naranja las zonas con presencia de gas

Pista 4 registro indicativo de gas con 1 para zonas con evidencia de gas y 0 donde no hay gas

# Cálculo de volumen de gas en arenas apretadas

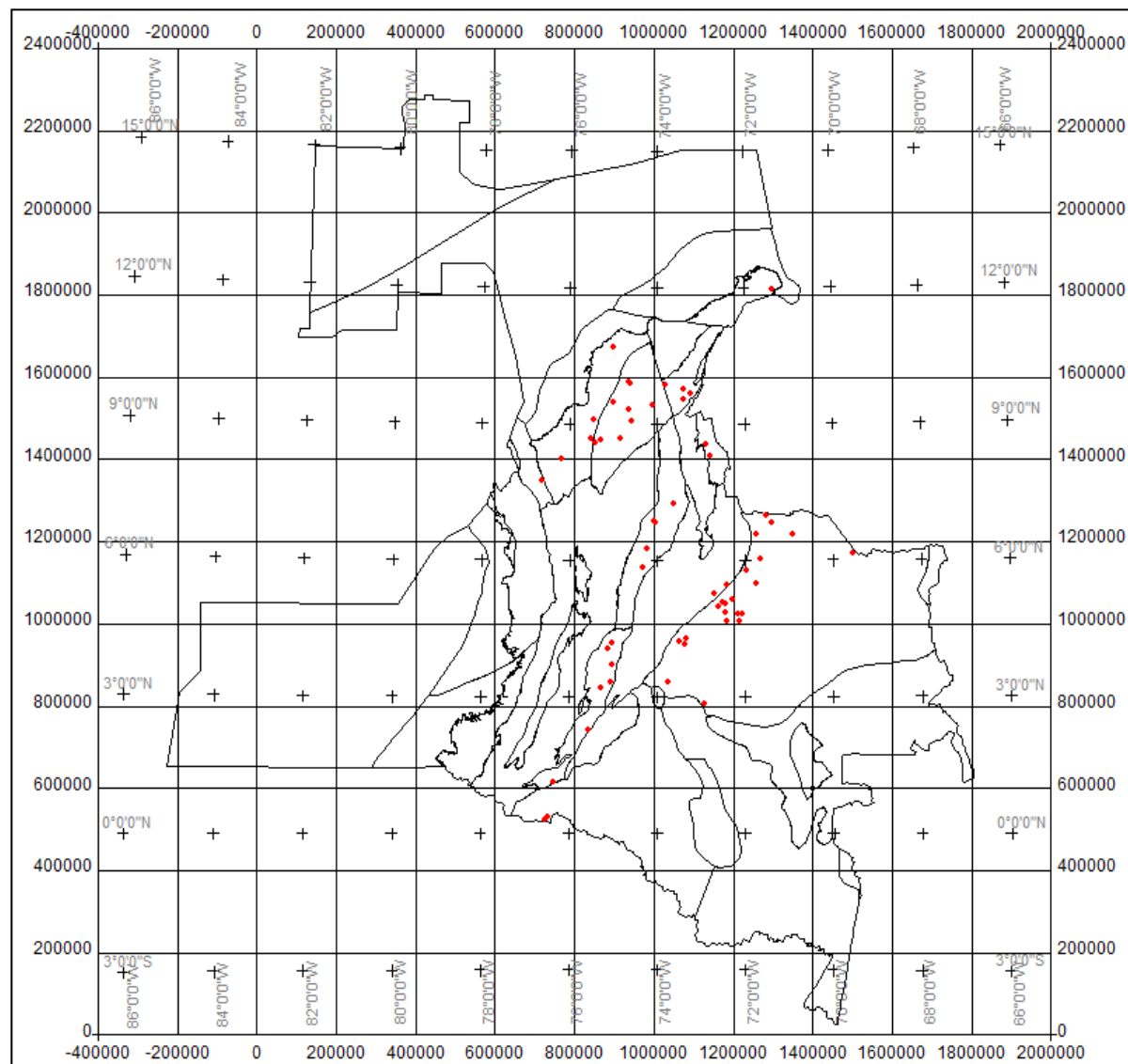


Principales plays de gas en rocas apretadas (Tight gas Play) en 13 cuencas de EEUU. (U.S.A. Energy information Administration s.f.)

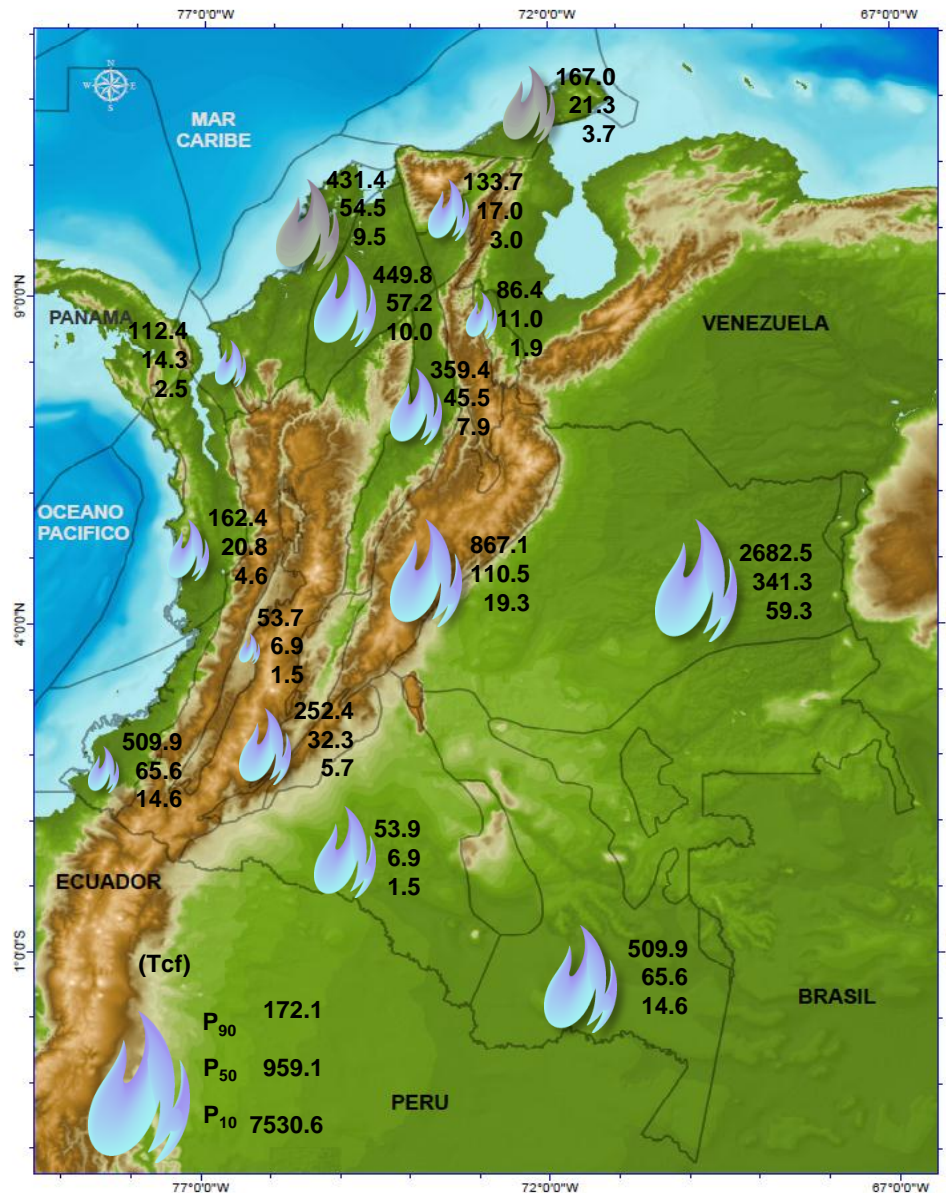
**% Área máxima potencial = 34.8%**

# Estimación del potencial de gas en arenas apretadas

## Pozos con evidencia de gas en arenas apretadas



En el mapa se observan los 63 pozos (puntos rojos) que resultaron con presencia de gas en arenas apretadas.





## Potencial de Crudos Pesados en Colombia

- 1. Neto - pozos (Ntg)
- 2. Productor - pozos (Pay)
- 3. Productor - reportado (Pay)

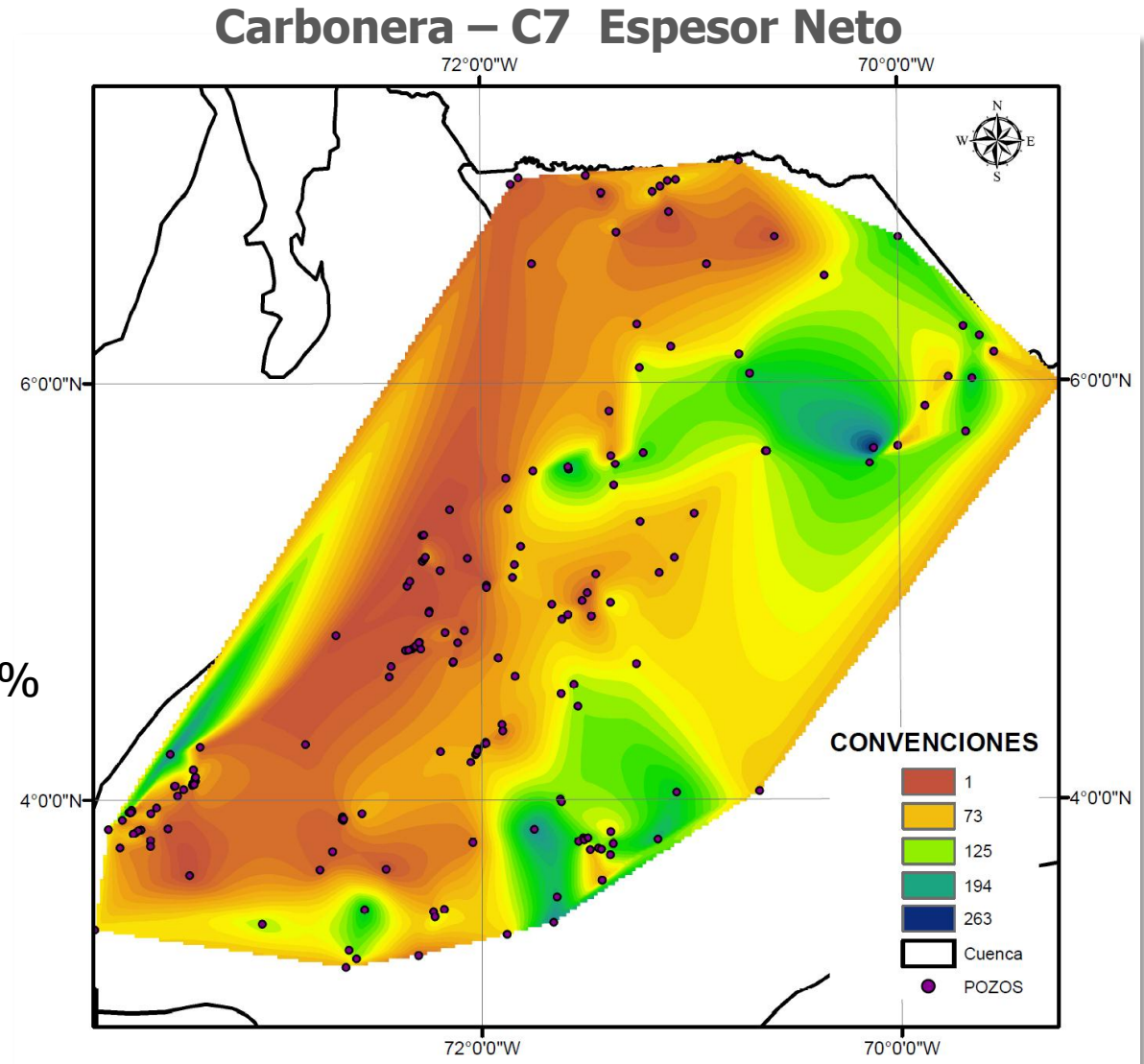


## Hipótesis

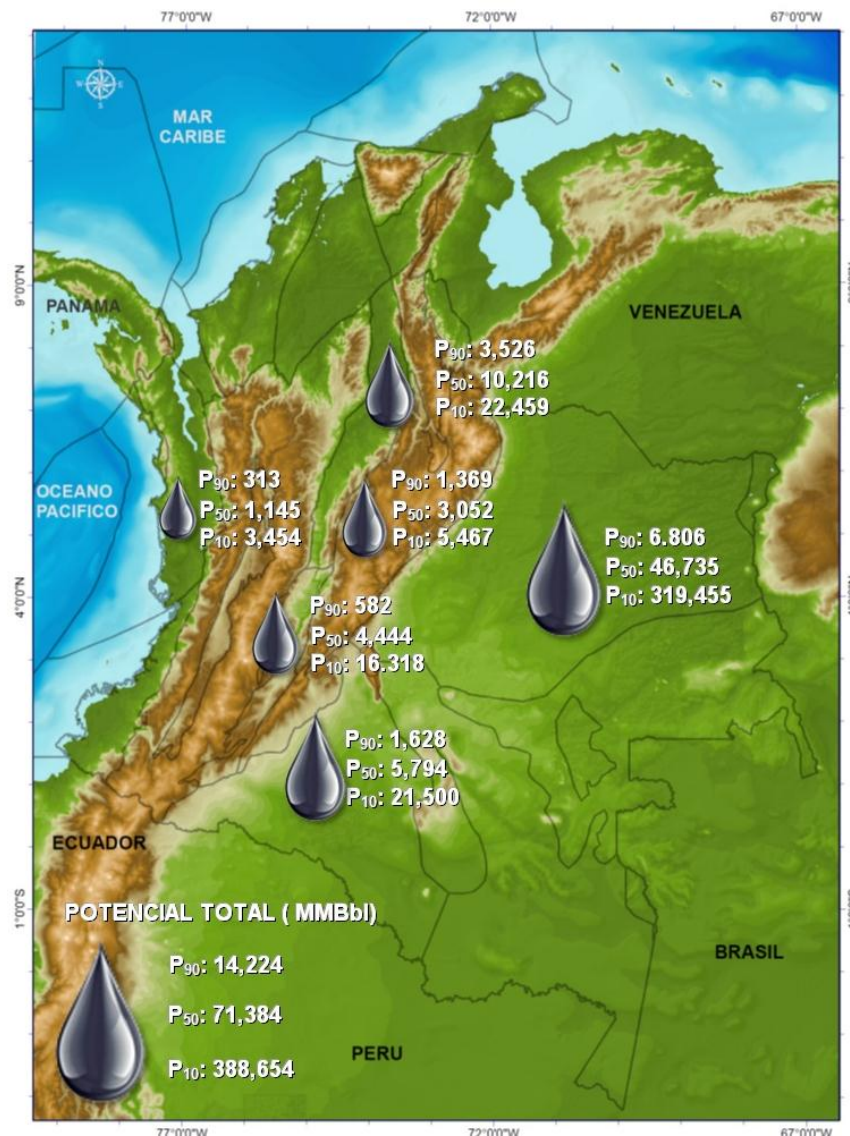
- Espesores de totales

## Hipótesis

- Espesor Neto :  $\Phi > 10\%$
- Espesor Productor:  $Sw < 50\%$



# Potencial de crudos pesados



# Matriz del recurso hidrocarburifero

<b>Recurso MMBOE / MMbbl</b>	<b>P<sub>10</sub></b>	<b>P<sub>50</sub></b>	<b>P<sub>90</sub></b>
Hidratos de gas	13 040	843	3 282
Tar Sand	6 813	921	156
Shale Oil	91 078	2 220	60
Shale Gas	2 525 394	326 801	41 513
Tight gas	7 531	959	172
Heavy Oil	388 654	71 384	14 224
OOIP	3 711 077	1 017 097	172 299
Gas asociado	409 566	28 918	630
OGIP	347 619	41 179	4 988
<b>Total Potencial</b>	<b>7 500 772</b>	<b>1 490 322</b>	<b>237 325</b>
<b>Total Generado</b>	<b>106 602 950</b>	<b>18 627 890</b>	<b>3 116 500</b>

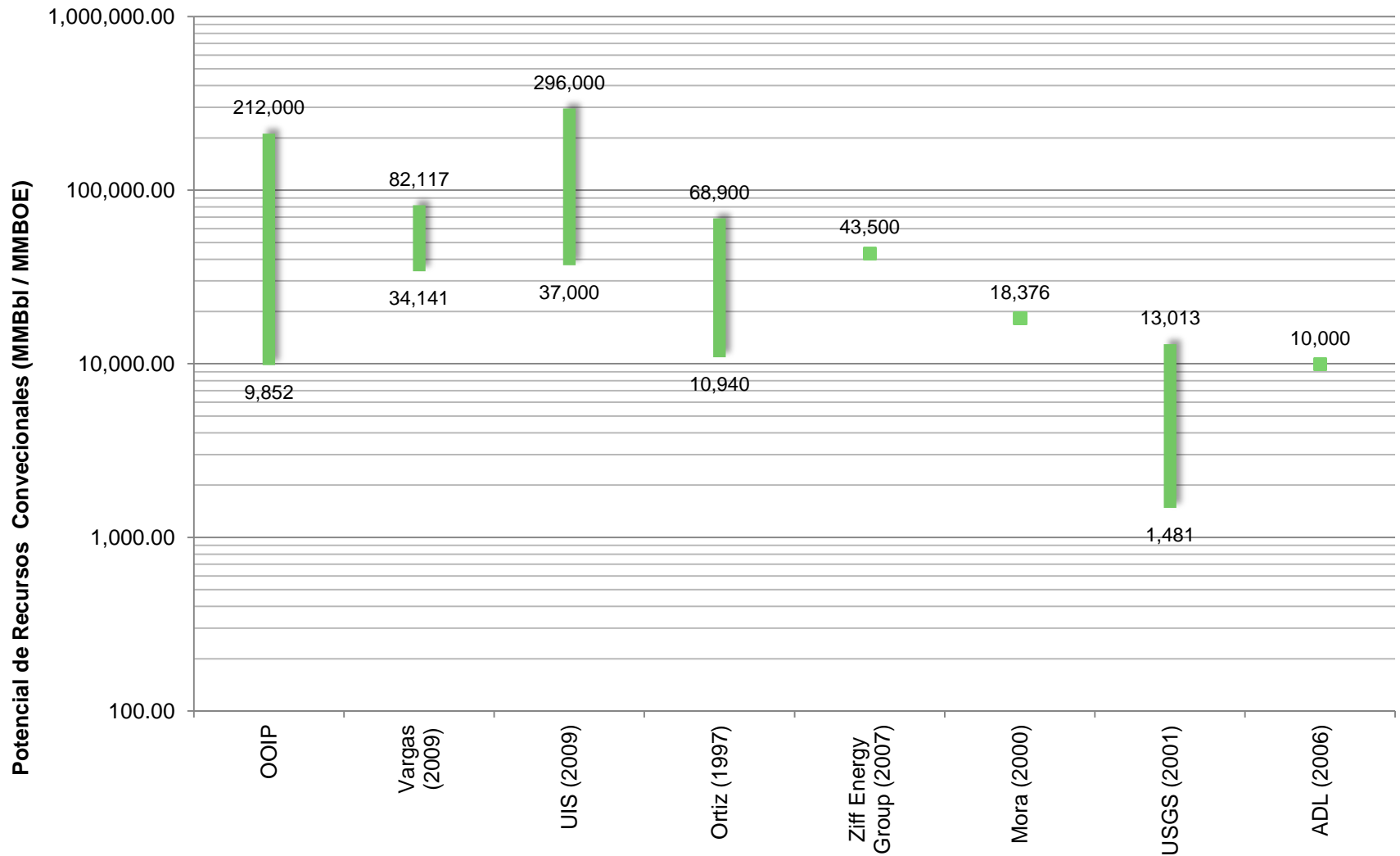
**% del generado**

**~7.6%**

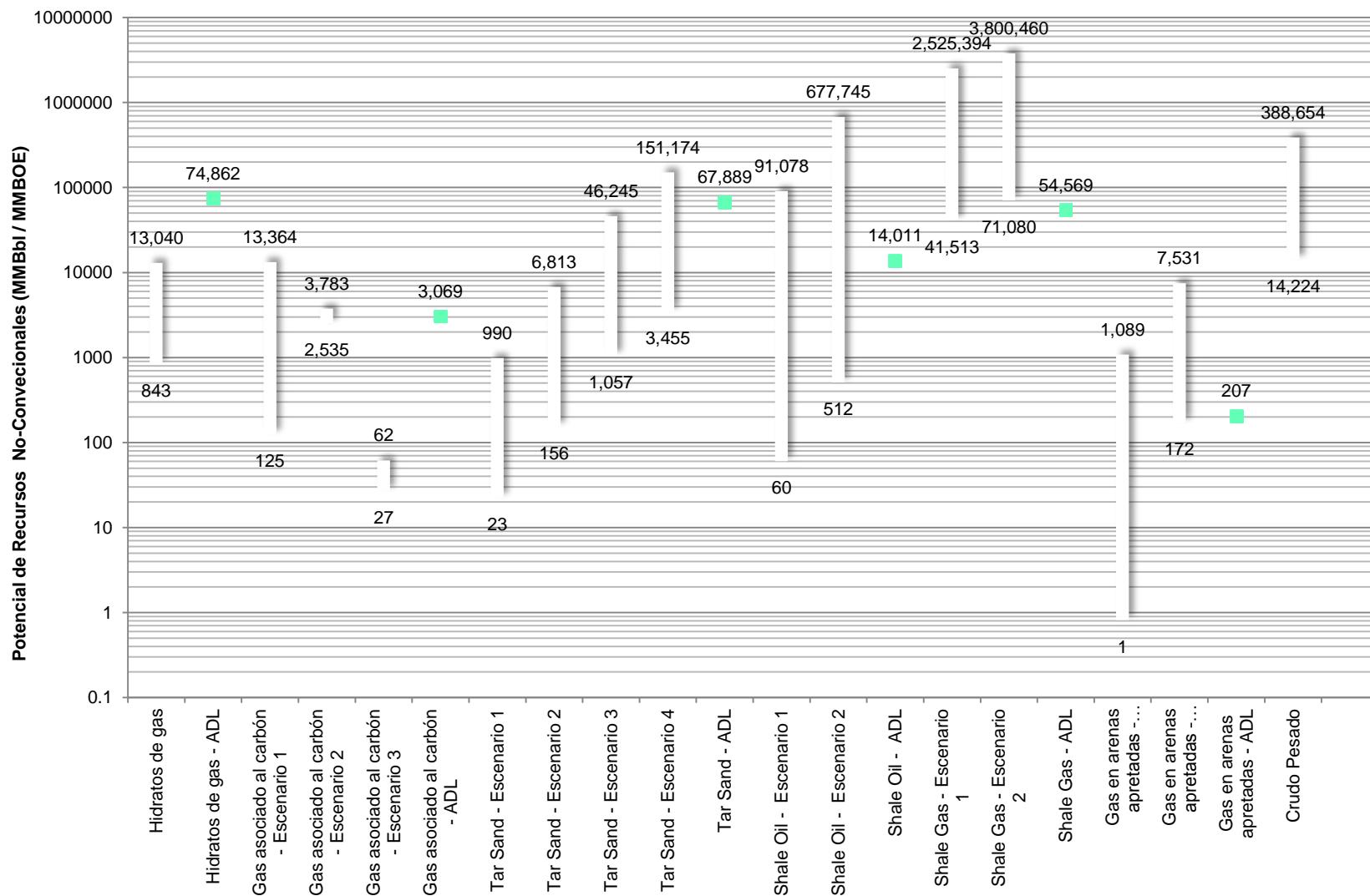
**% YTF (Conv/Potencial)**

**~30%**

# Otros estudios (convencional)



# Otros estudios (no convencional)





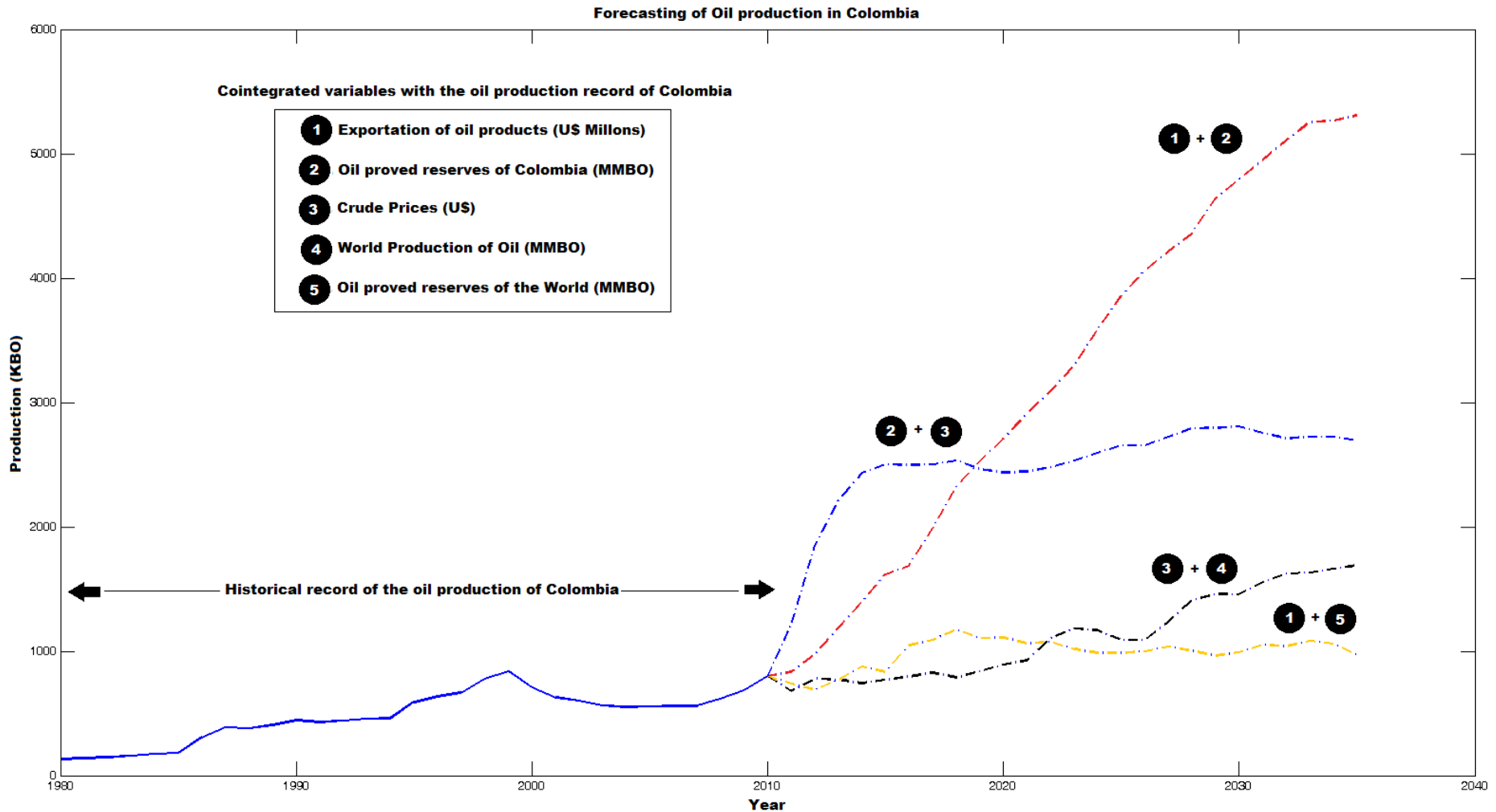
CUENCA / RECURSO (MMBOE / MMbbl)	Hidratos de Gas			Gas asociado al carbón			Tar Sand		
	P <sub>10</sub>	P <sub>50</sub>	P <sub>90</sub>	P <sub>10</sub>	P <sub>50</sub>	P <sub>90</sub>	P <sub>10</sub>	P <sub>50</sub>	P <sub>90</sub>
Amaga	-	-	-	89.0	16.5	0.8	-	-	-
Caguan-Putumayo	-	-	-	28.8	5.4	0.3	437.0	59.1	10.0
Catatumbo	-	-	-	117.6	22.1	1.1	-	-	-
Cauca Patía	-	-	-	124.2	23.3	1.1	19.0	2.6	0.4
Cesar Ranchería	-	-	-	3,053.9	568.3	27.8	19.0	2.6	0.4
Choco	-	-	-	-	-	-	134.9	18.2	3.1
Choco Marino	8,081.1	2,033.0	522.7	-	-	-	-	-	-
Cordillera Oriental	-	-	-	790.5	149.5	7.5	965.8	130.5	22.1
Cuenca Colombia	329.3	82.8	20.7	-	-	-	-	-	-
Guajira	-	-	-	143.6	26.9	1.4	36.1	4.9	0.8
Guajira Marino	2,100.5	530.3	136.0	-	-	-	-	-	-
Llanos Orientales	-	-	-	-	-	-	877.7	118.6	20.1
Los Cayos	Podría tener recurso - no se realizo estimación			-	-	-	-	-	-
Pacifico Colombiano	635.1	159.6	41.6	-	-	-	-	-	-
Sinu-San Jacinto	-	-	-	5,739.2	1,092.8	54.0	-	-	-
Sinu Marino	992.2	249.7	63.7	-	-	-	-	-	-
Tumaco	-	-	-	-	-	-	21.6	2.9	0.5
Tumaco Marino	901.9	227.1	58.5	-	-	-	-	-	-
Uraba	-	-	-	Podría tener recurso - no se realizo estimación			-	-	-
Valle Inferior Del Magdalena	-	-	-	43.5	8.2	0.4	111.9	15.1	2.6
Valle Medio Del Magdalena	-	-	-	766.9	143.2	7.3	927.5	125.3	21.2
Valle Superior Del Magdalena	-	-	-	1,927.2	362.0	18.5	807.9	109.2	18.5
Vaupés-Amazonas	-	-	-	Podría tener recurso - no se realizo estimación			182.8	24.7	4.2
<b>TOTAL RECURSO</b>	<b>13,040.0</b>	<b>3,282.5</b>	<b>843.0</b>	<b>12,824.2</b>	<b>2,418.4</b>	<b>120.1</b>	<b>4,541.1</b>	<b>613.7</b>	<b>103.8</b>

# Matriz del recurso

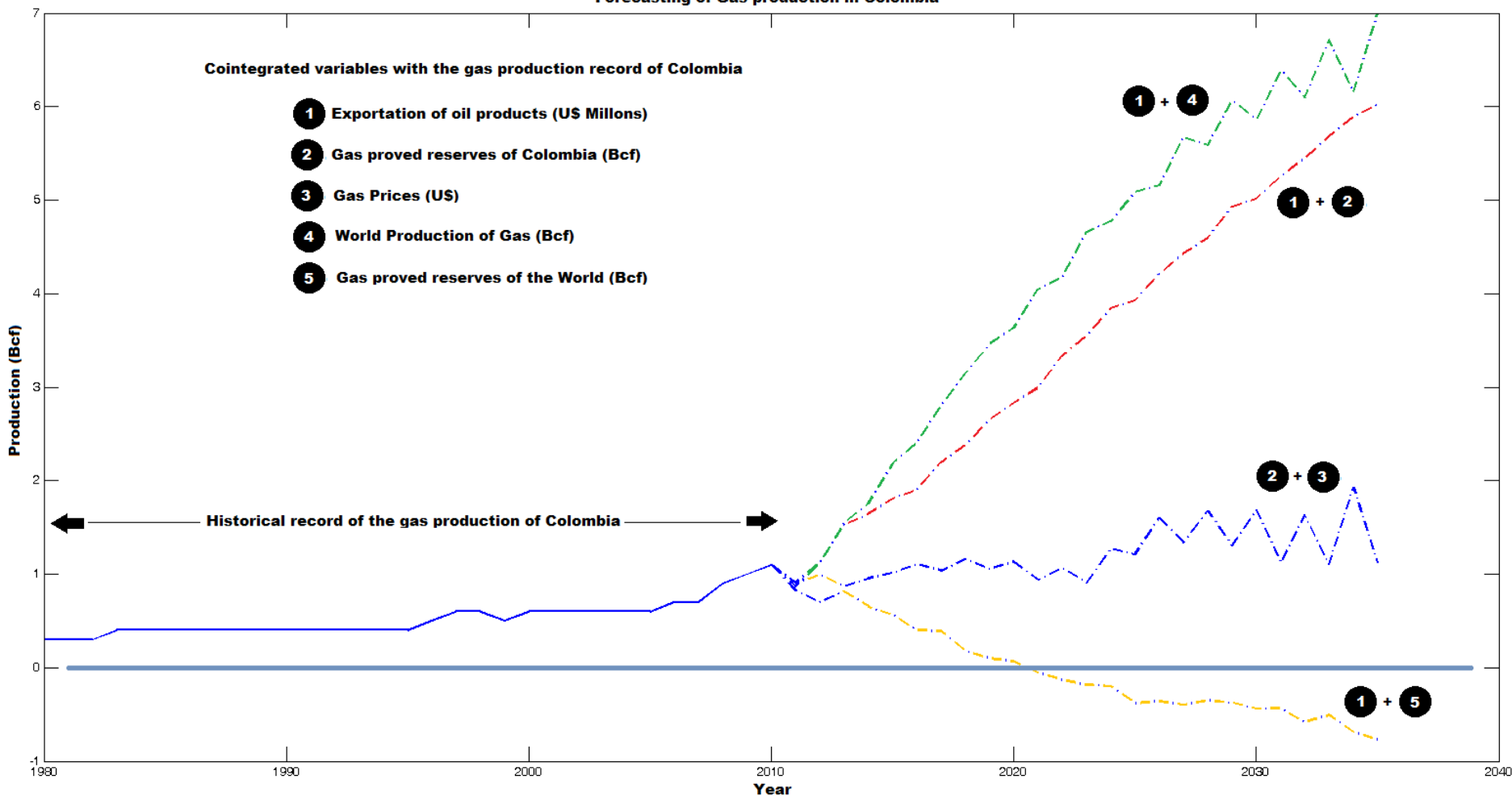
CUENCA / RECURSO (MMBOE / MMbbl)	Shale Oil			Shale Gas			Gas en Arenas Apretadas		
	P <sub>10</sub>	P <sub>50</sub>	P <sub>90</sub>	P <sub>10</sub>	P <sub>50</sub>	P <sub>90</sub>	P <sub>10</sub>	P <sub>50</sub>	P <sub>90</sub>
Amaga	-	-	-	-	-	-	-	-	-
Caguan-Putumayo	10,443.3	198.7	1.2	463,379.3	21,993.6	2,380.8	53.9	6.9	1.5
Catatumbo	412.2	10.9	0.3	31,971.0	6,720.0	843.5	86.4	11.0	1.9
Cauca Patía	85.0	3.6	0.1	-	-	-	-	-	-
Cesar Ranchería	240.1	7.8	0.2	18,469.9	4,907.7	720.9	133.7	17.0	3.0
Choco	39,432.2	549.6	7.3	3,918.2	1,188.1	185.6	-	-	-
Choco Marino	-	-	-	-	-	-	-	-	-
Cordillera Oriental	14,564.9	682.2	28.3	125,733.8	35,630.1	5,450.4	867.1	110.5	19.3
Cuenca Colombia	-	-	-	-	-	-	-	-	-
Guajira	294.6	9.5	0.3	22,891.1	6,093.1	899.5	167.0	21.3	3.7
Guajira Marino	-	-	-	-	-	-	-	-	-
Llanos Orientales	-	-	-	1,141,309.2	179,731.3	21,621.2	2,682.5	341.3	59.3
Los Cayos	-	-	-	-	-	-	-	-	-
Pacífico Colombiano	-	-	-	-	-	-	-	-	-
Sinu-San Jacinto	2,678.0	99.3	3.0	76,091.4	19,524.4	2,822.6	431.4	54.5	9.5
Sinu Marino	-	-	-	-	-	-	-	-	-
Tumaco	798.9	33.3	1.2	9,779.8	2,925.7	457.9	-	-	-
Tumaco Marino	-	-	-	-	-	-	-	-	-
Uraba	5.5	0.3	0.0	15,727.8	4,029.4	579.8	112.4	14.3	2.5
Valle Inferior Del Magdalena	1,950.3	97.1	4.1	20,915.9	6,042.3	930.1	449.8	57.2	10.0
Valle Medio Del Magdalena	622.9	13.9	0.3	25,654.6	7,500.7	1,157.1	359.4	45.5	7.9
Valle Superior Del Magdalena	5,986.4	240.9	8.5	7,823.4	2,323.1	359.8	252.4	32.3	5.7
Vaupés-Amazonas	259.1	4.9	0.0	556,567.2	26,646.5	2,863.1	509.9	65.6	14.6
<b>TOTAL RECURSO</b>	<b>77,773.5</b>	<b>1,952.1</b>	<b>54.8</b>	<b>2,520,232.5</b>	<b>325,255.8</b>	<b>41,272.3</b>	<b>6,105.8</b>	<b>777.3</b>	<b>138.7</b>

# Matriz del recurso

CUENCA / RECURSO (MMBOE / MMbbl)	Crudo Pesado			Aceite			Gas (asociado y/o libre)					
	P <sub>10</sub>	P <sub>50</sub>	P <sub>90</sub>	P <sub>10</sub>	P <sub>50</sub>	P <sub>90</sub>	P <sub>10</sub>	P <sub>50</sub>	P <sub>90</sub>			
Amaga	-	-	-	-	-	-	-	-	-			
Caguan-Putumayo	21,500.0	5,794.0	1,628.0	206.2	67.6	17.0	7.8	0.9	0.11			
Catatumbo	438.6	119.9	20.0	104.7	29.3	8.2	4.4	0.3	0.01			
Cauca Patía	-	-	-	2,242.7	614.2	102.3	29.8	2.1	0.05			
Cesar Ranchería	-	-	-	2,038.0	559.1	93.1	4.8	0.4	0.02			
Choco	3,454.0	1,145.0	313.0	6,622.6	1,813.9	299.1	7.0	0.6	0.05			
Choco Marino	-	-	-	6,201.5	1,701.0	283.4	29.0	2.2	0.07			
Cordillera Oriental	5,467.0	3,052.0	1,369.0	11,159.0	3,064.3	507.3	22.1	1.8	0.09			
Cuenca Colombia	-	-	-	44,823.4	12,277.5	2,038.2	19.7	2.4	0.30			
Guajira	-	-	-	-	-	-	1.0	0.1	0.01			
Guajira Marino	-	-	-	-	-	-	3.9	0.5	0.06			
Llanos Orientales	319,455.0	46,735.0	6,806.0	1,600.9	439.6	72.8	19.8	2.2	0.23			
Los Cayos	-	-	-	21,207.3	5,800.0	960.4	10.7	1.3	0.15			
Pacifico Colombiano	-	-	-	45,793.6	12,594.0	2,080.8	19.4	2.3	0.29			
Sinu-San Jacinto	-	-	-	6,634.8	1,821.3	302.3	5.1	0.5	0.04			
Sinu Marino	-	-	-	4,030.4	1,107.6	183.6	7.6	0.6	0.04			
Tumaco	1,397.6	382.7	63.5	2,210.0	813.1	301.0	3.2	0.3	0.03			
Tumaco Marino	-	-	-	4,885.9	1,339.9	222.2	12.5	1.0	0.05			
Uraba	-	-	-	2,173.7	349.5	78.4	1.9	0.2	0.01			
Valle Inferior Del Magdalena	2,288.7	629.5	104.3	6,491.0	1,777.9	296.4	6.1	0.6	0.04			
Valle Medio Del Magdalena	22,459.0	10,216.0	3,526.0	5,854.7	1,601.7	265.6	3.5	0.3	0.04			
Valle Superior Del Magdalena	16,318.0	4,444.0	582.0	492.0	135.0	22.4	5.2	0.4	0.03			
Vaupes-Amazonas	7,363.4	2,011.3	334.7	25,257.5	6,917.2	1,152.7	9.2	1.1	0.14	TOTAL HIDROCARBURO EN COLOMBIA		
<b>TOTAL RECURSO</b>	400,141.3	74,529.4	14,746.4	200,029.8	54,823.6	9,287.0	233.6	22.0	1.8	P <sub>10</sub> 3,234,921.8	P <sub>50</sub> 463,674.7	P <sub>90</sub> 66,567.9



Forecasting of Gas production in Colombia



## Informe Final

### Libro «**Potencial de hidrocarburos en Colombia**»

- Bases de datos nacional e internacionales (xls)
- Estimaciones: Datos depurados e hipótesis (xls)
- Proyectos en Kingdom Suit (Sísmica y Pozos)

**Muchas gracias !**

**Carlos A. Vargas**

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