



# **Petroleum Systems of the Colombian Caribbean Basins**

**Bogotá - Houston – London –Singapore - Calgary**



# Offshore Colombia Technical Review

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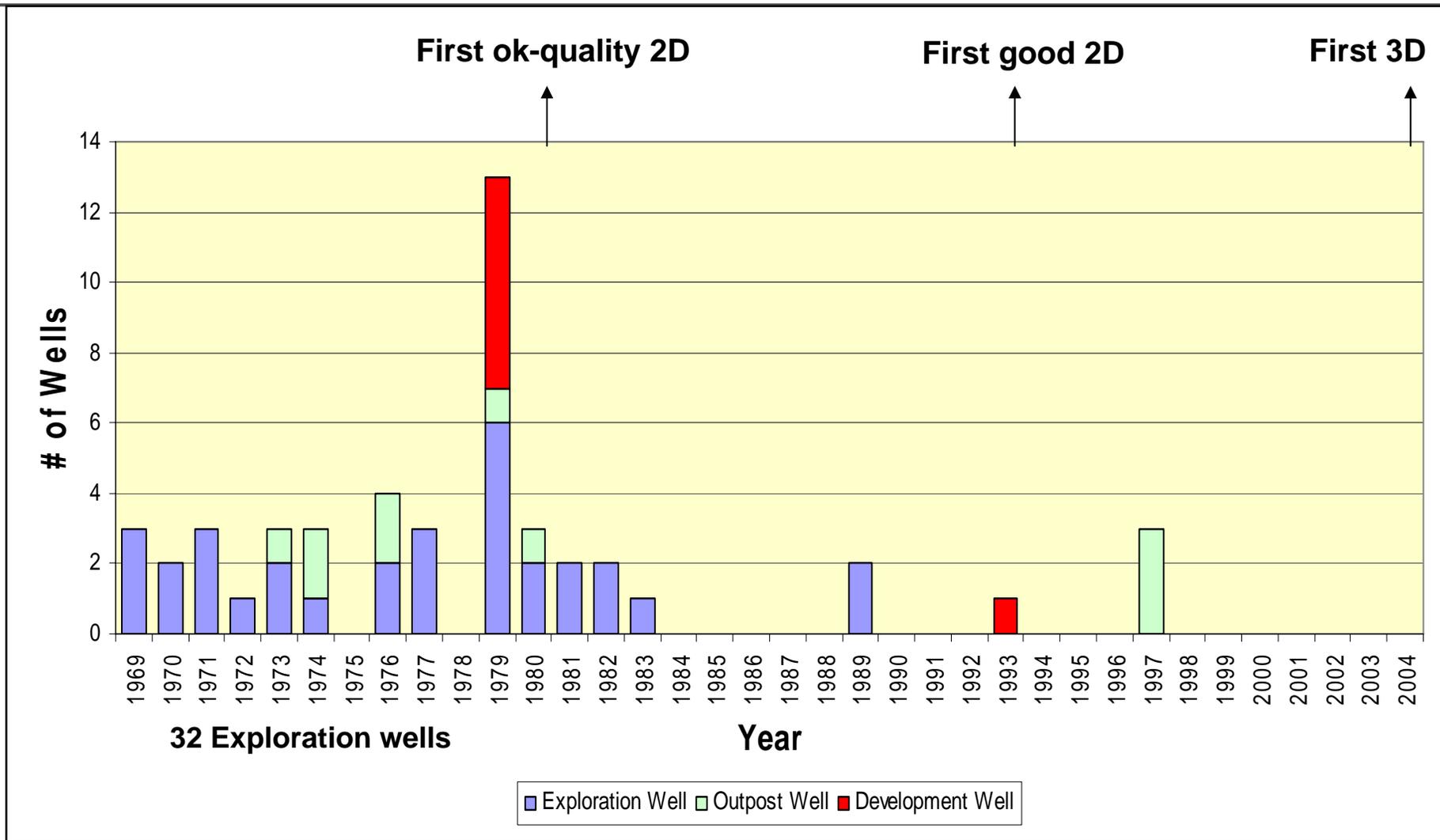
- Regional Overview
  - Block locations
  - Seismic and Well data bases
  - Tectonic setting
- Source Rocks
- Reservoir Rocks
- Trap Styles
- Northeast Area
- Central Area
- Southwest Area
- Conclusions

## Regional Exploration Overview

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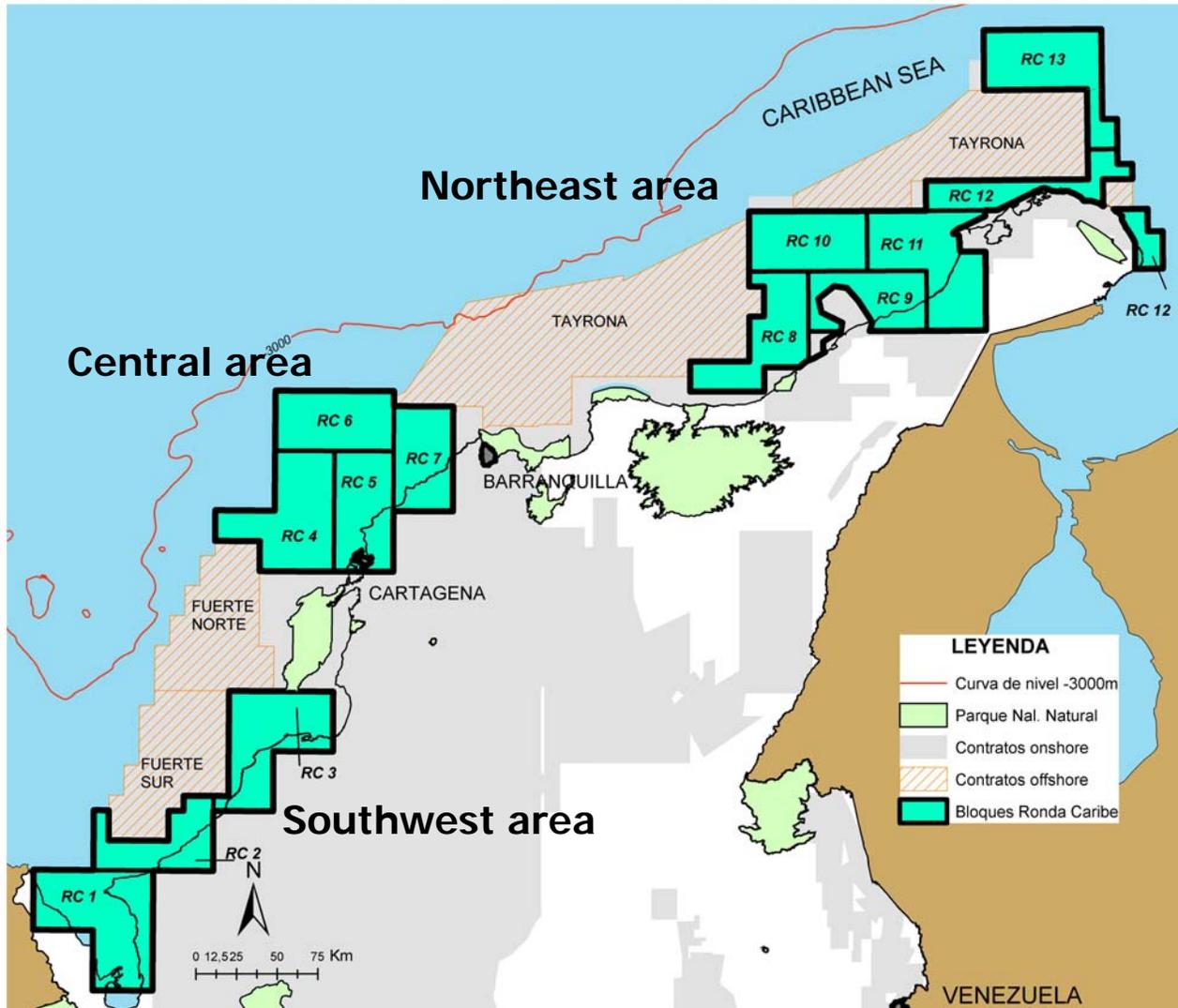
- Under-explored region with a viable petroleum system
  - ❑ Three producing gas fields in the northeastern area
  - ❑ Central and Southwestern drop core data supports the presence of hydrocarbons
  - ❑ No wells drilled in deep water
  - ❑ No wells drilled in Southwest area since 1978
    - Drilling activity pre-dates majority of seismic acquisition
- Seismic data quality is good
  - ❑ Multiple “leads” identified based on current data set
  - ❑ Insufficient current seismic to upgrade leads to prospect status
- Leads have been identified in both deep and shallow water areas

# Colombia, Offshore Caribbean Exploration History for entire area



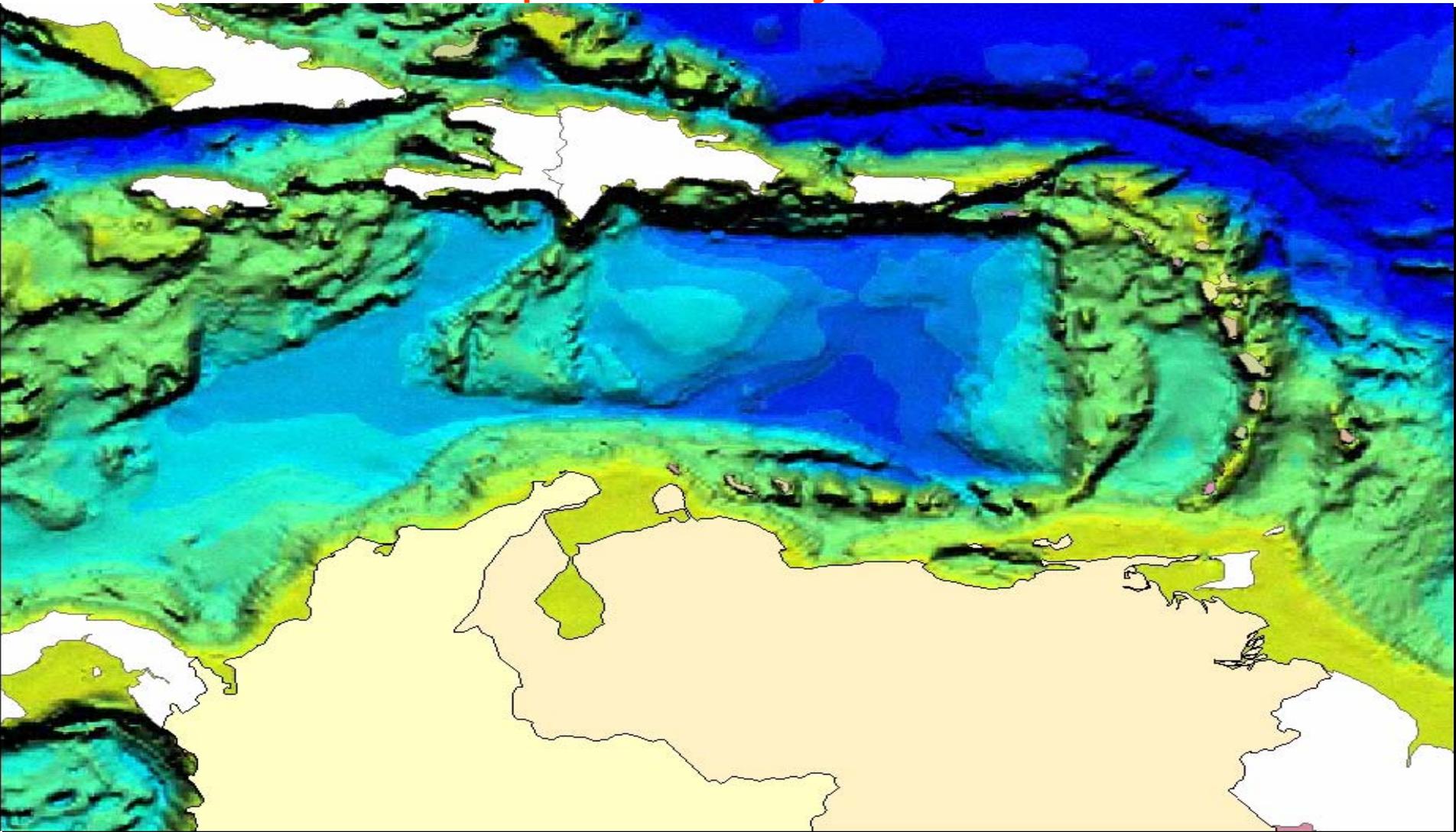
# Colombian Caribbean Basins:

13 Blocks on Offer, average size 3,000 km<sup>2</sup> (125 GOM blocks per block)



# Tectonic Setting:

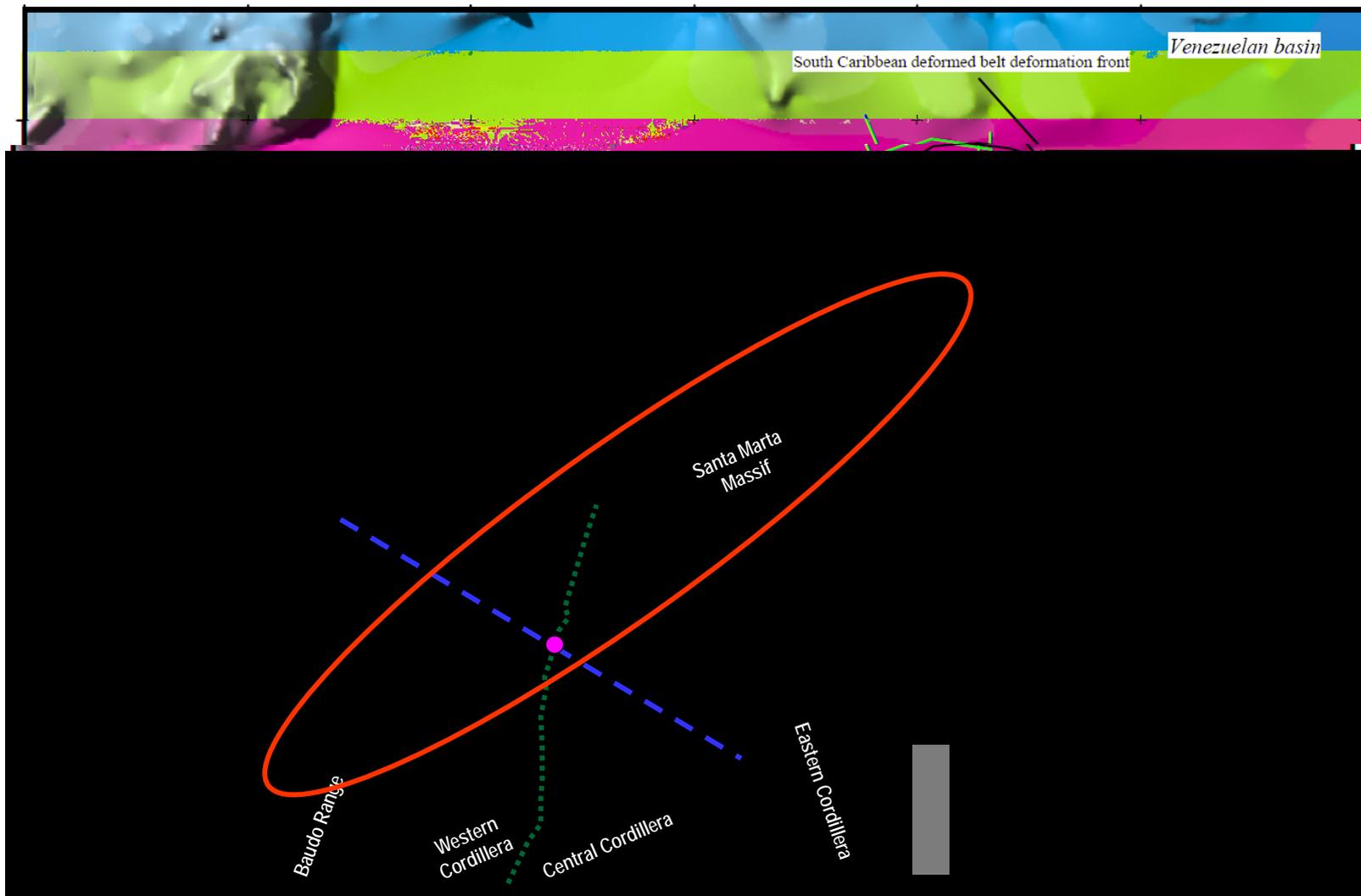
Ideal scenario for Multiple Petroleum Systems



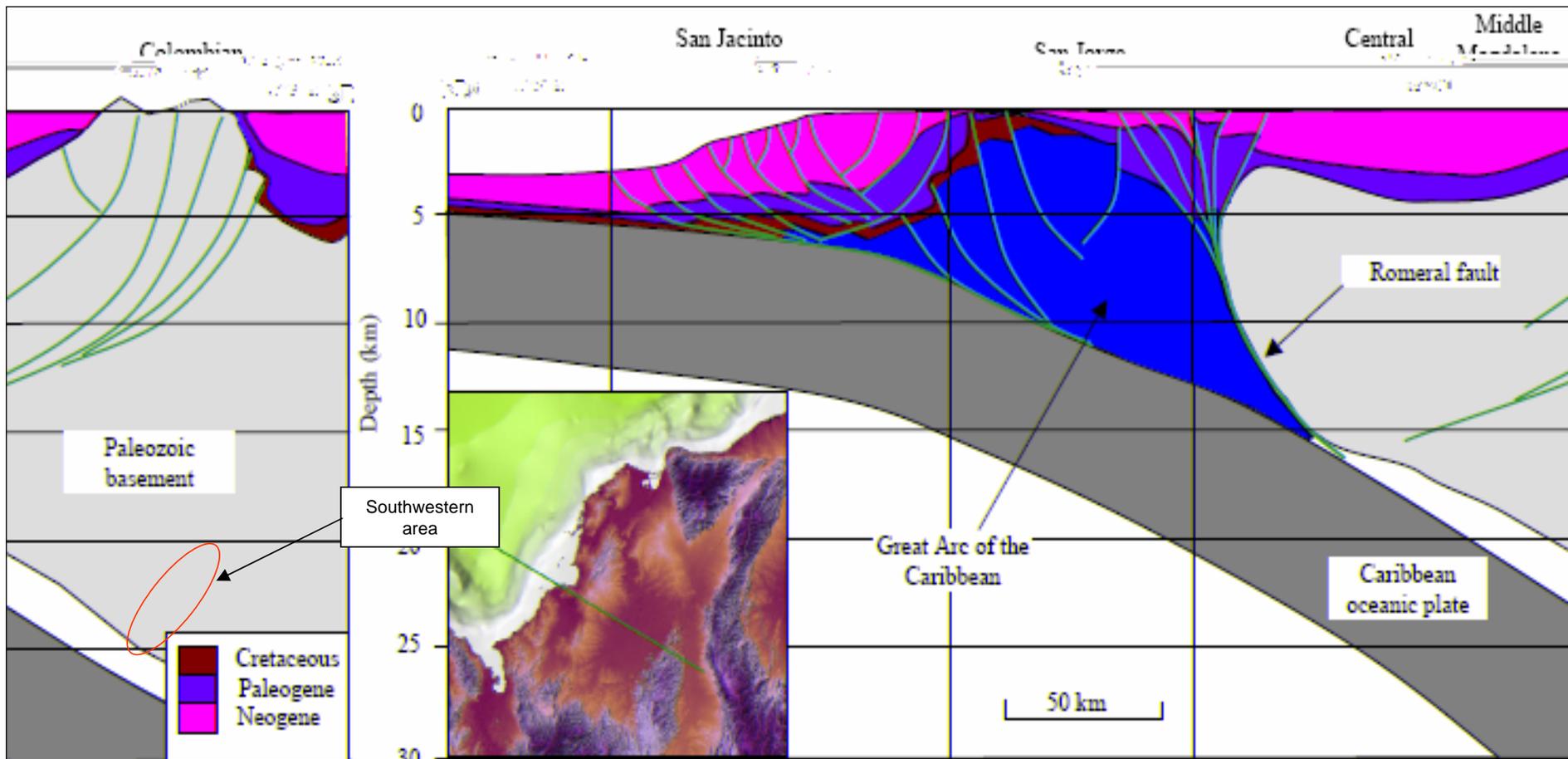


# Tectonic Provinces:

## Multiple Depositional / Structural Provinces

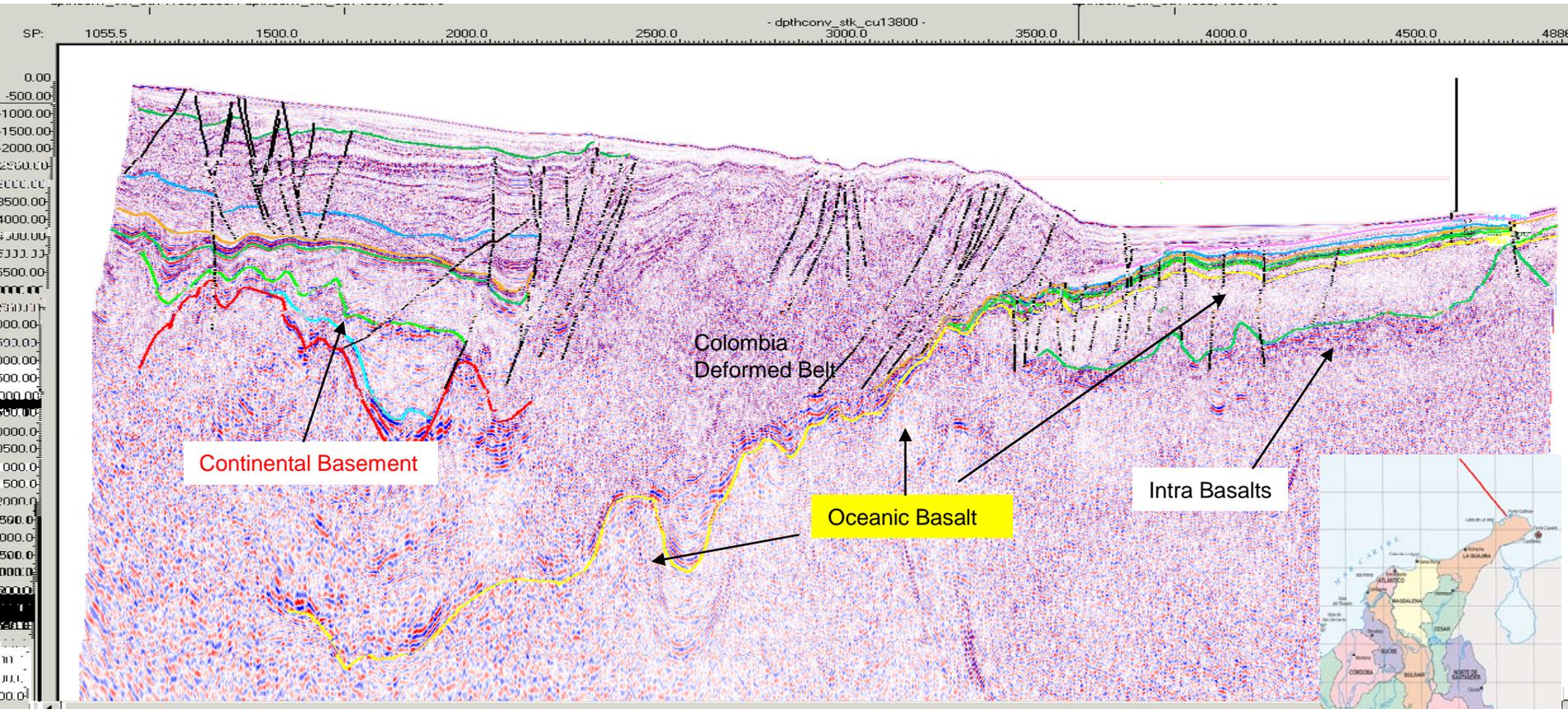


# Geological Cross-Section: Characterization of Structural Model in Southern Area



# Subduction of Oceanic Basalts:

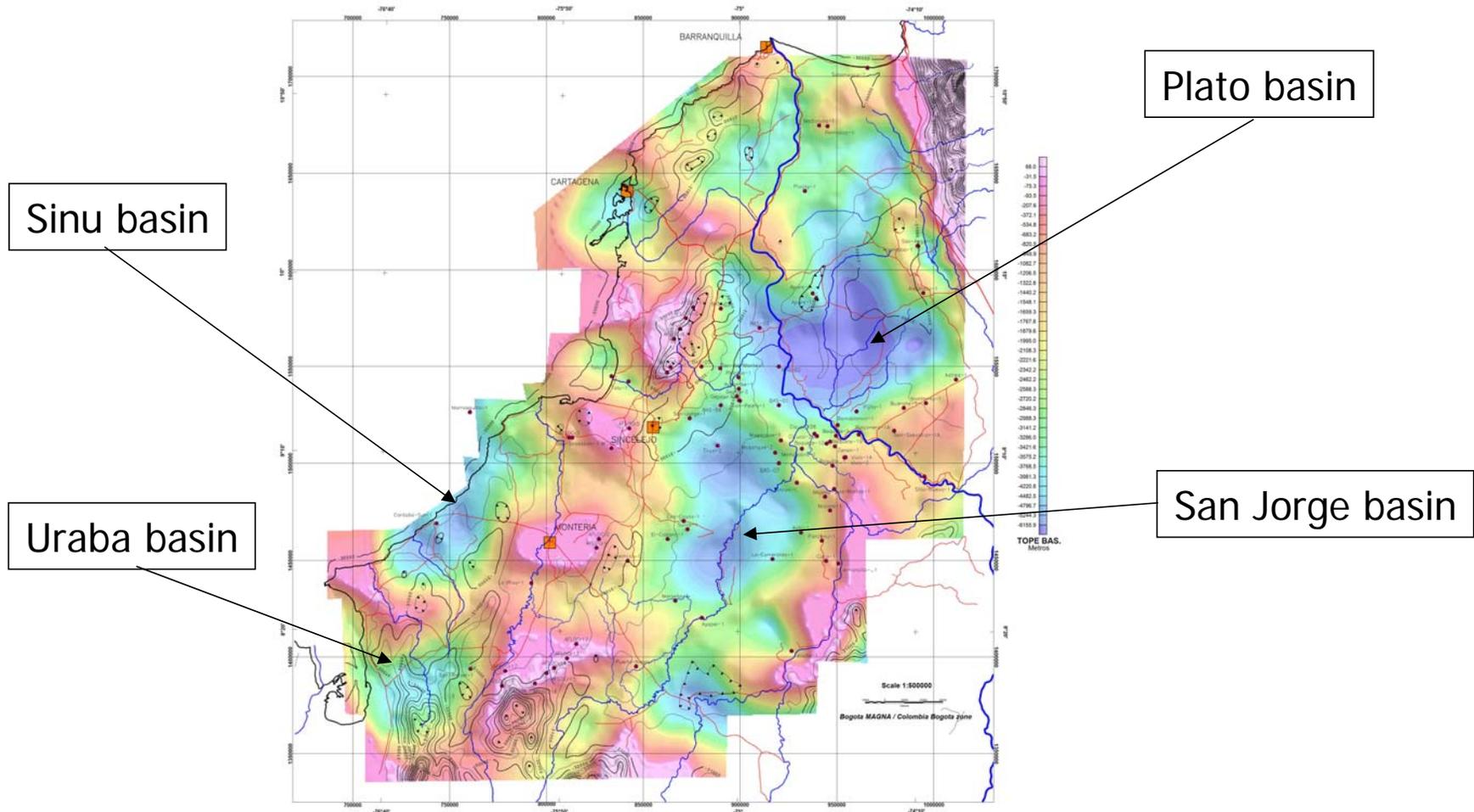
## Seismic Example Demonstrating Structural Model Northeastern Area



GX TECHNOLOGY 

Line 13800 – Tie to DSDP-153

# Bouguer anomalies: Continuous onshore-offshore basins



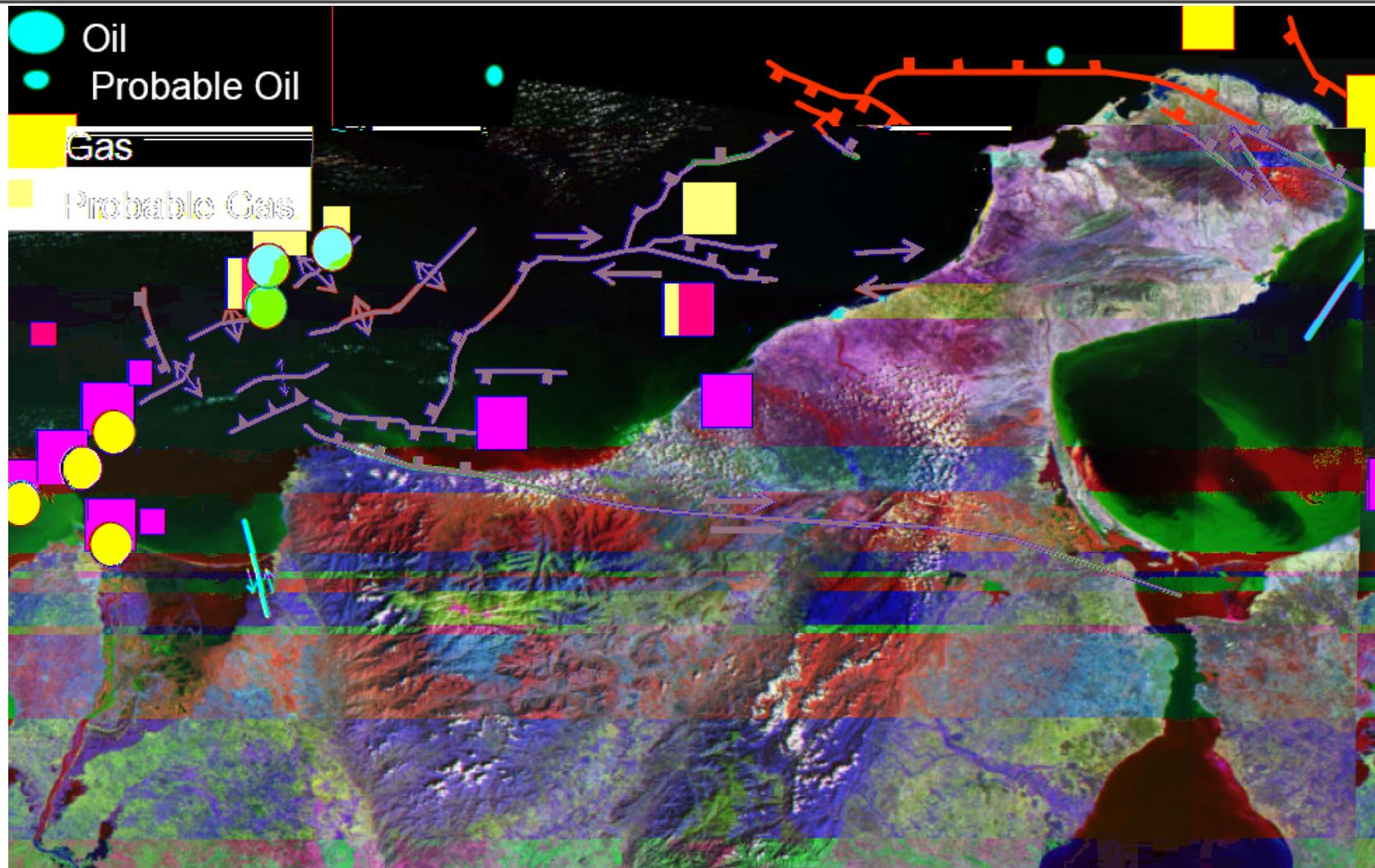


# Hydrocarbon Source

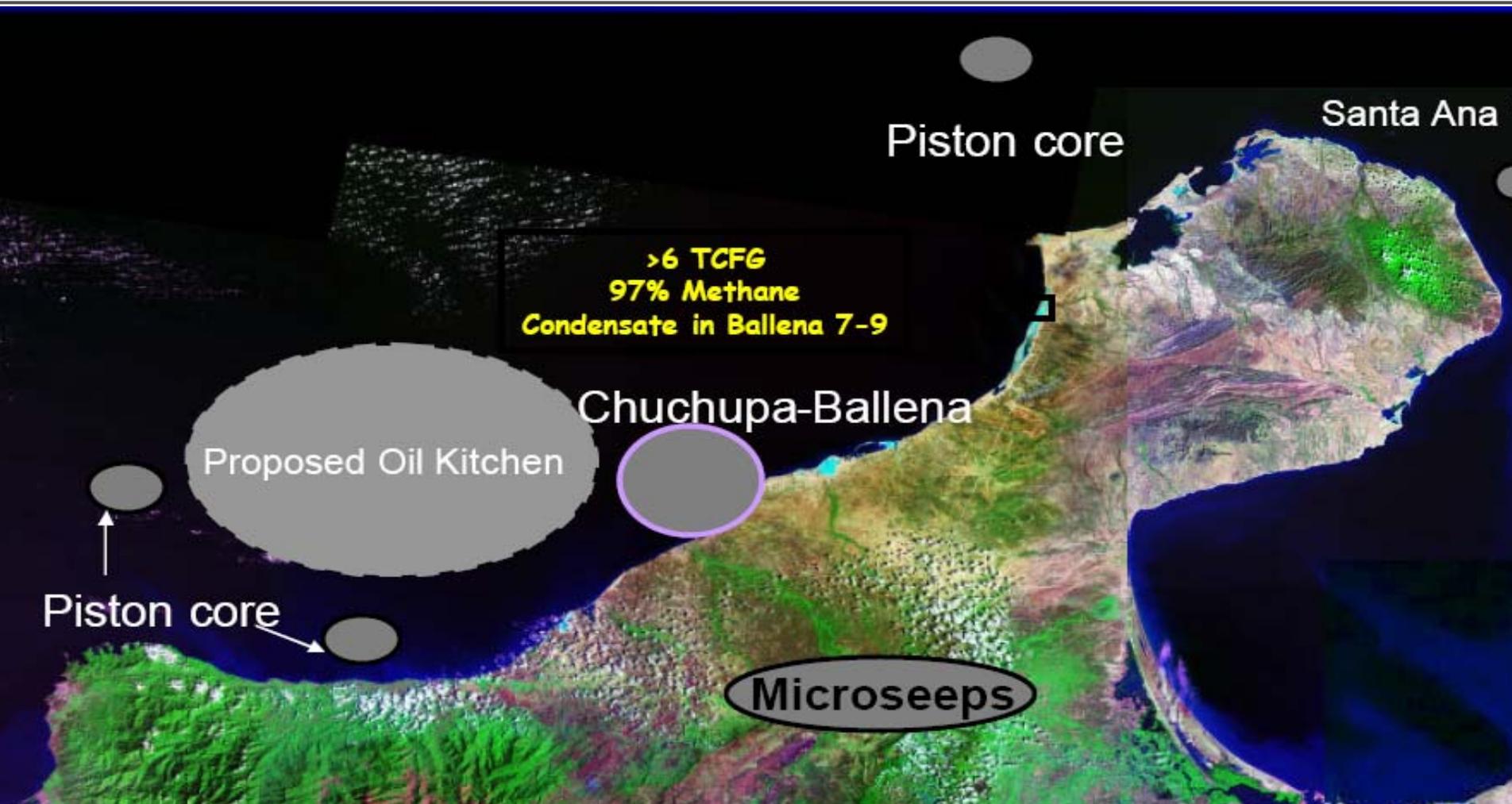


# Northeastern and Central AOIs:

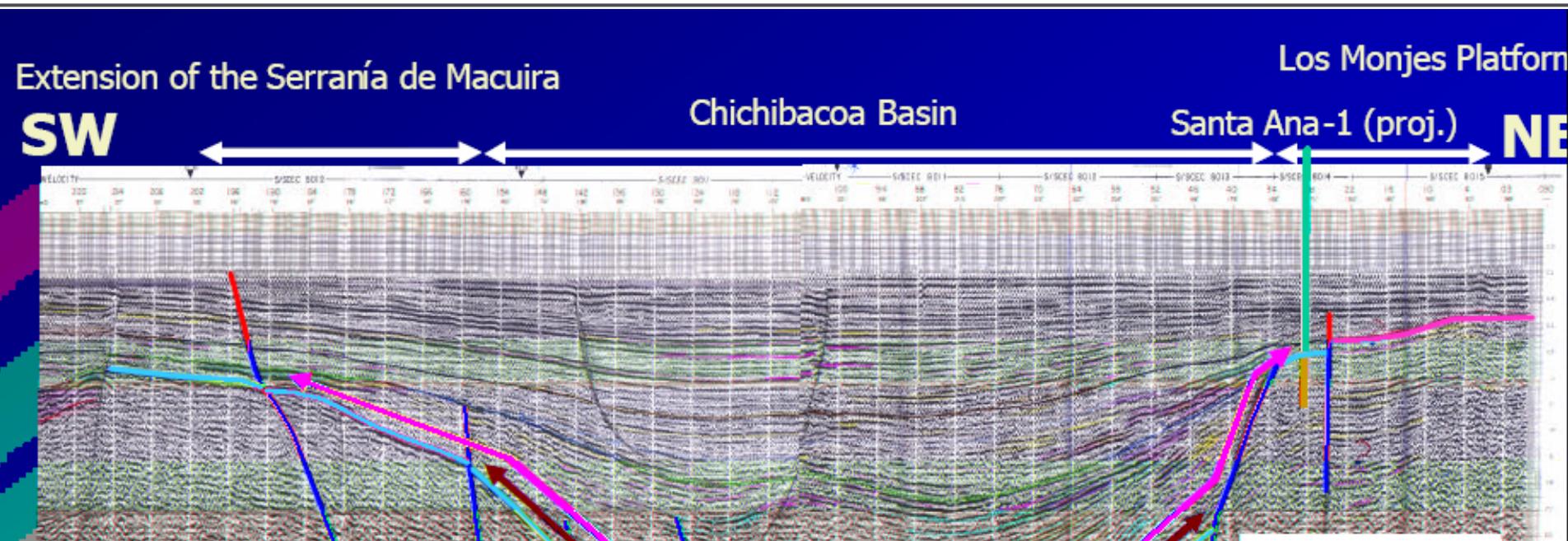
Evidence for Generation and Migration of Offshore Hydrocarbons



# Northern and Central AOIs: Generation Model and Evidence for Migration



# Northern and Central AOIs: Seismic Evidence for Kitchen Area and Migration Pathway

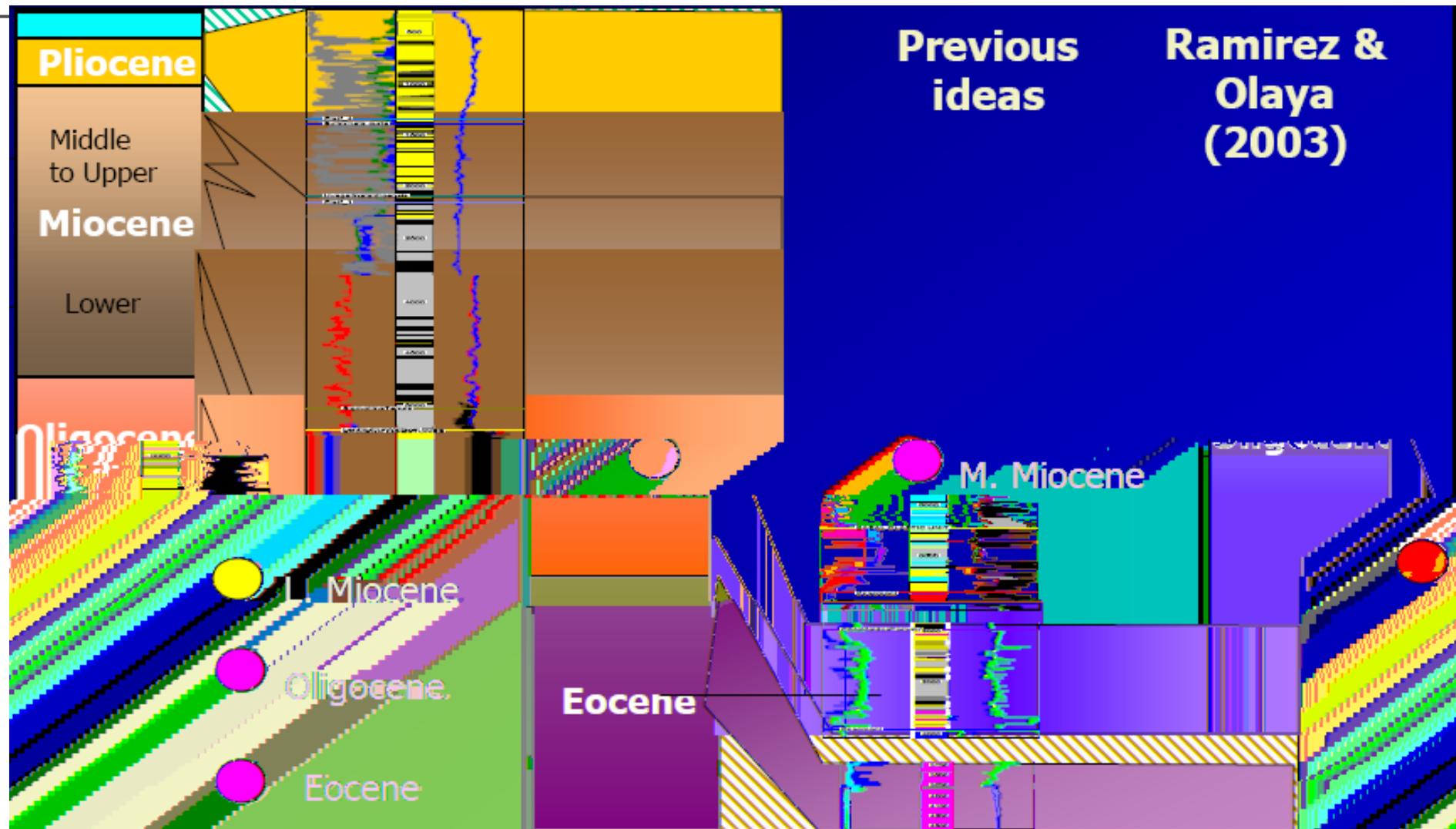




# Reservoir Rocks



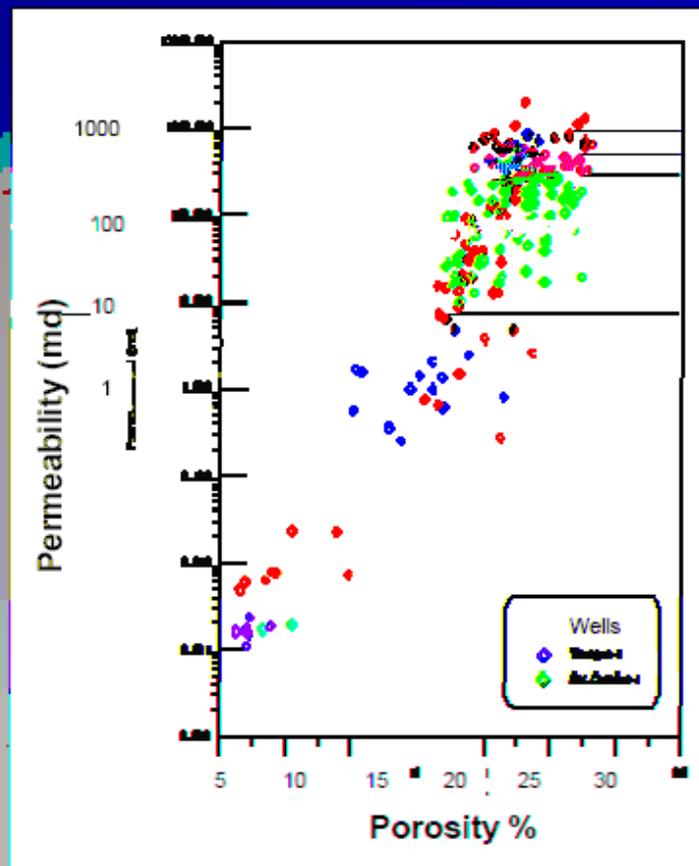
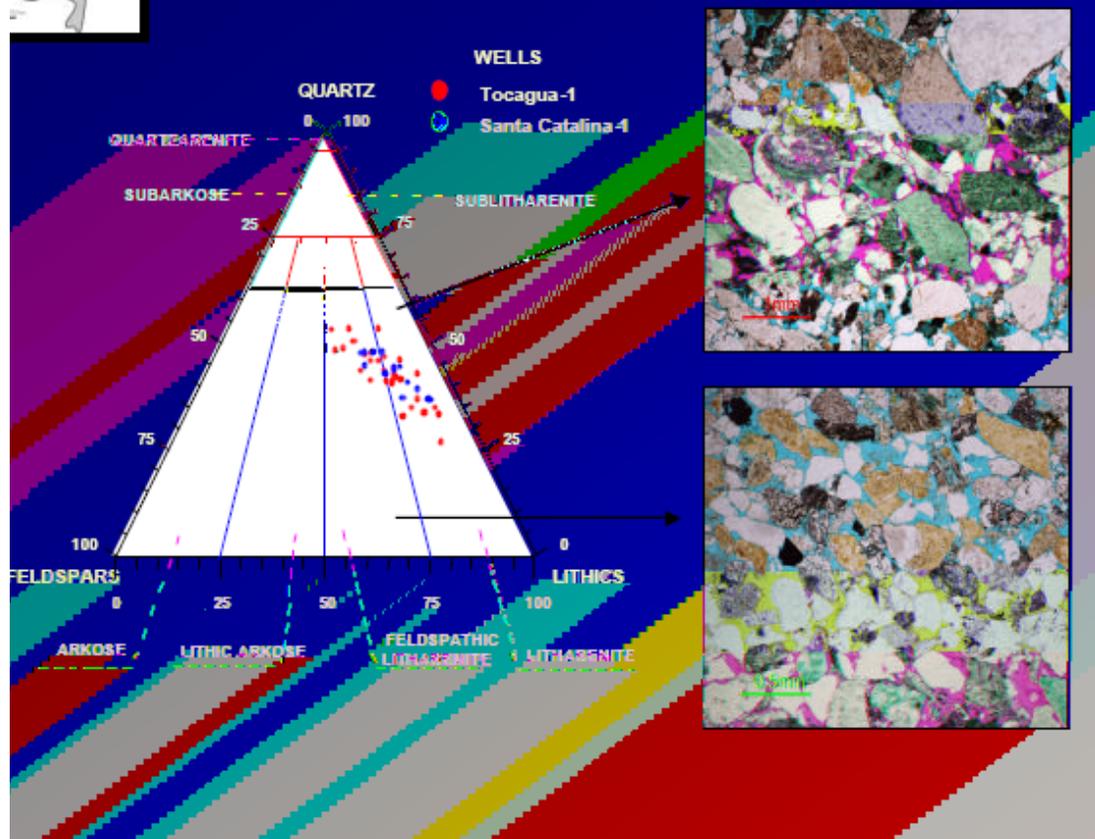
# Northern and Central AOIs: Multiple Possible Reservoir Targets



# Northern and Central AOIs: Empirical Evidence for Excellent Reservoirs



## Colombian Caribbean



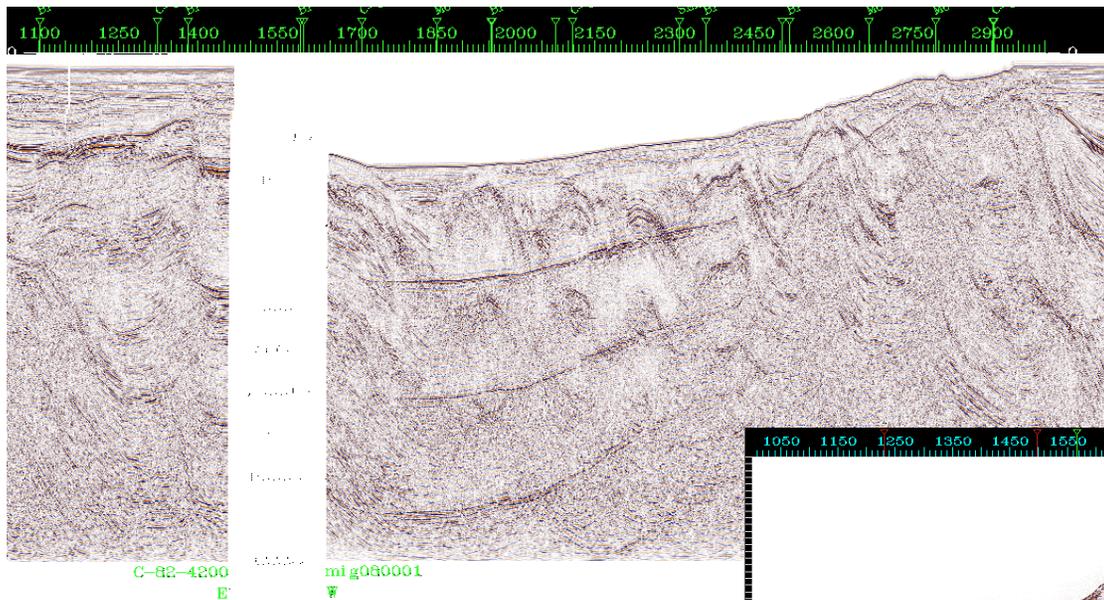


# Trap Styles



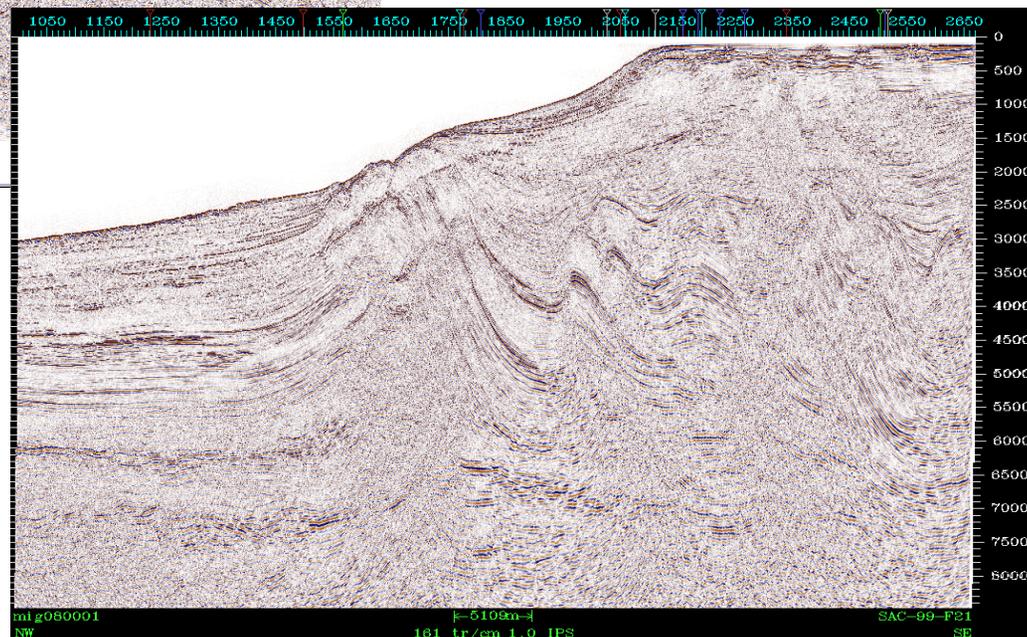
# Evolution of Seismic Imaging:

Improved Seismic Data Quality Creates Greater Mapping Confidence

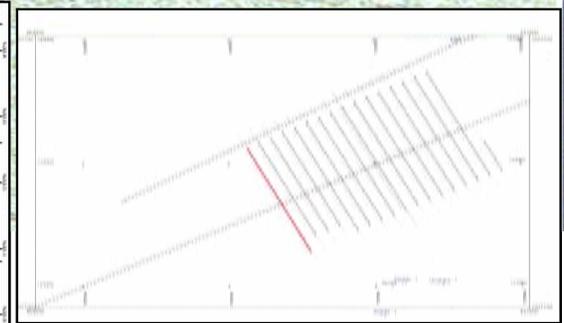
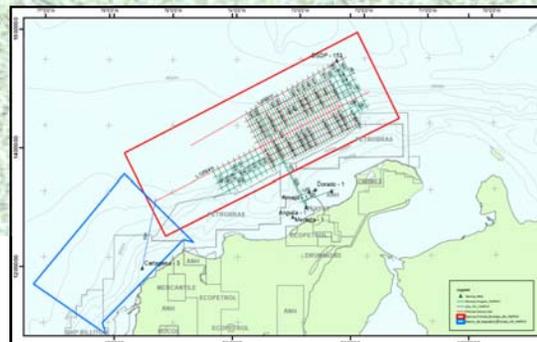
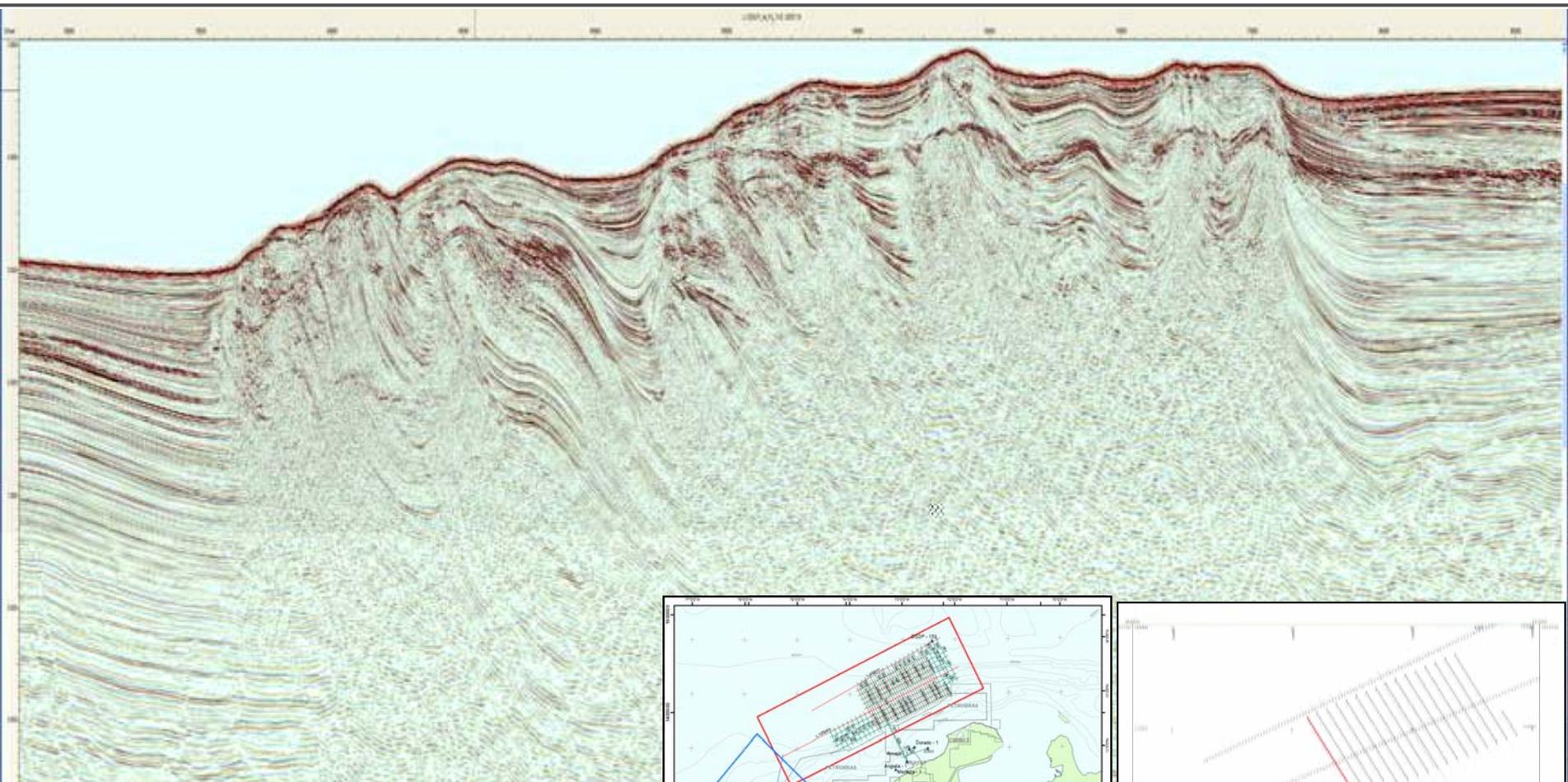


1980s vintage data. Only shot to 6 seconds and poor imaging at depth

1999 vintage data. Shot to 10 seconds. Much better imaging and processing

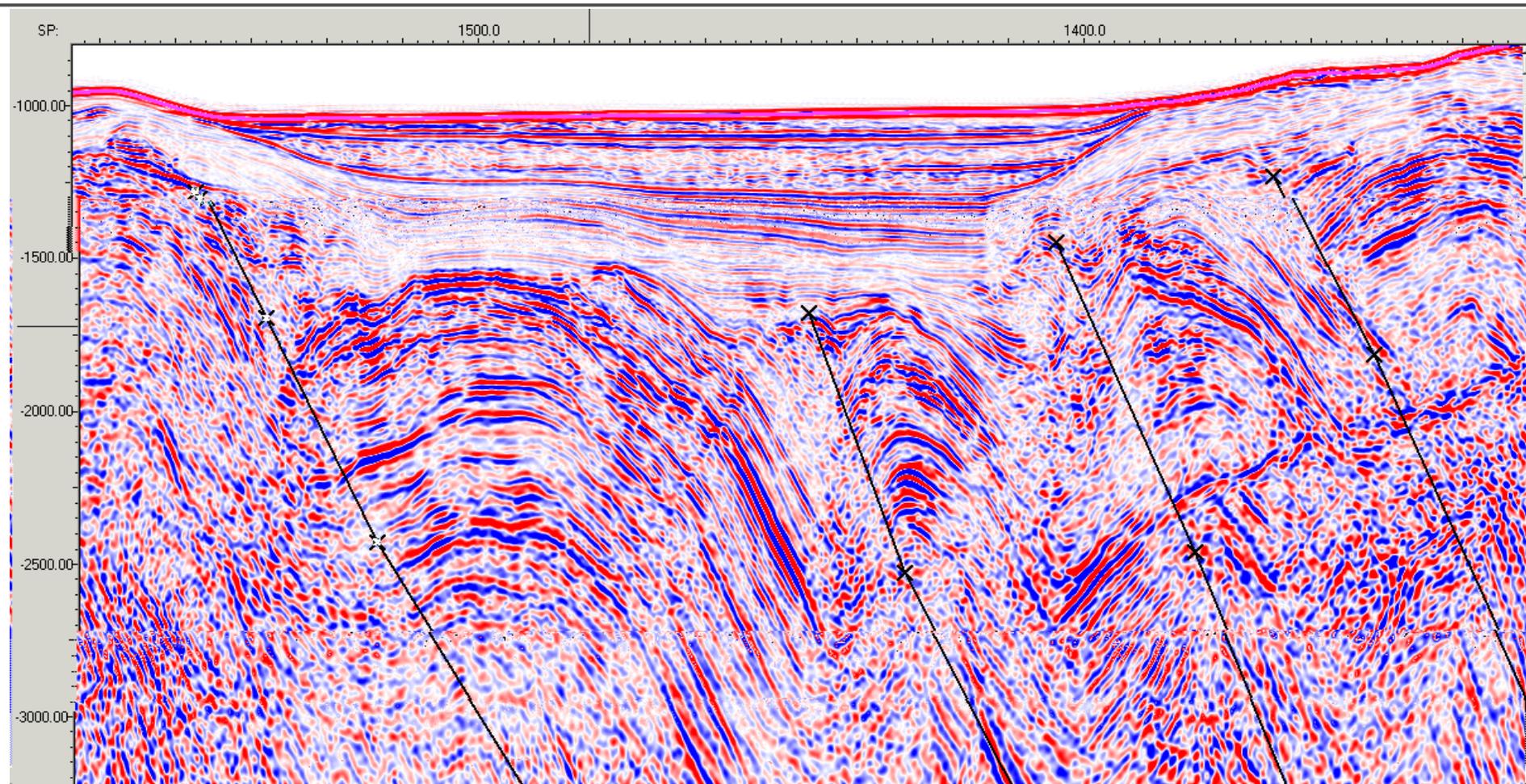


# 2004 Seismic Example: NW/SE CGG Example Section



# Play Types:

## GX Technology Example-Fault Propagation Folds



GX TECHNOLOGY



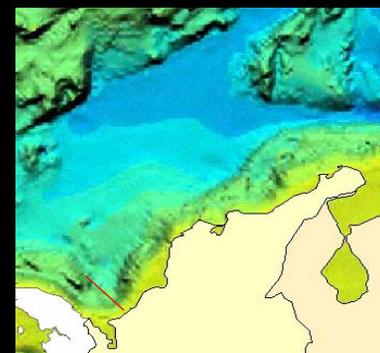
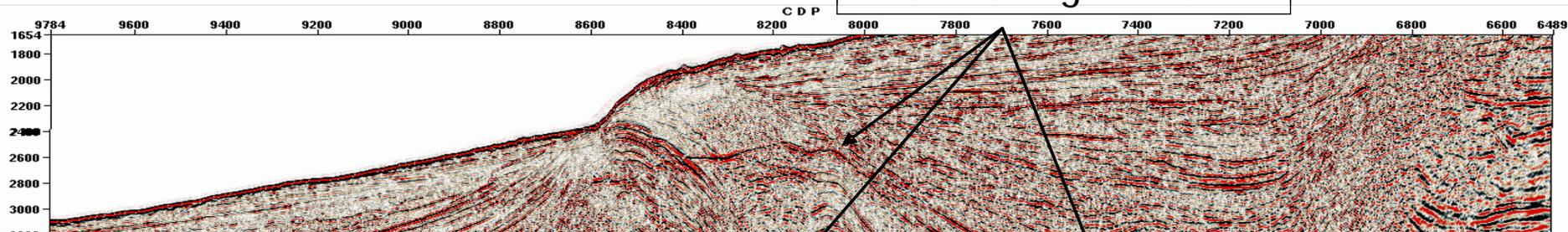
AGENCIA NACIONAL DE HIDROCARBUROS



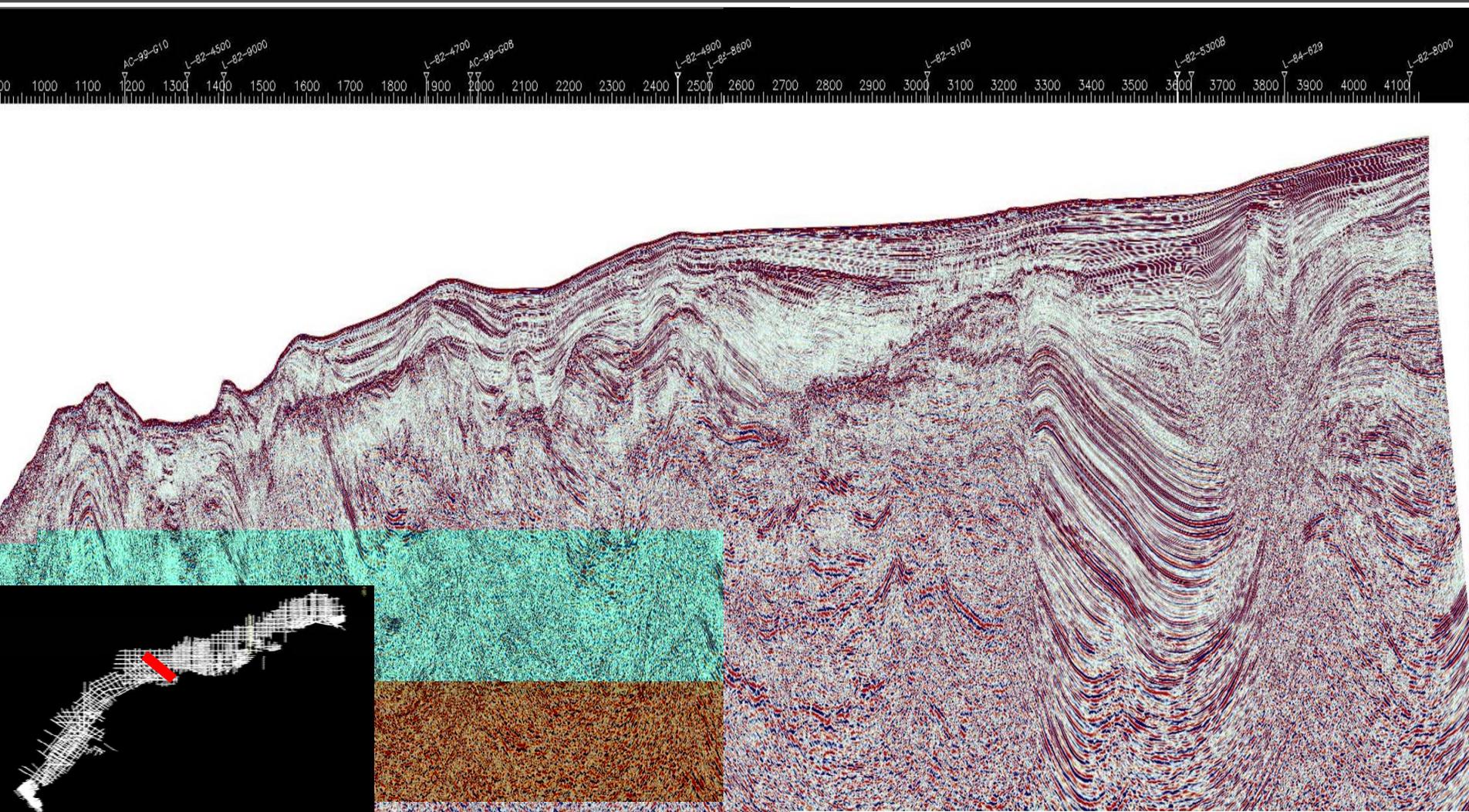
# Play Types:

## Multiple Trap Styles Seen on Improved Modern Seismic

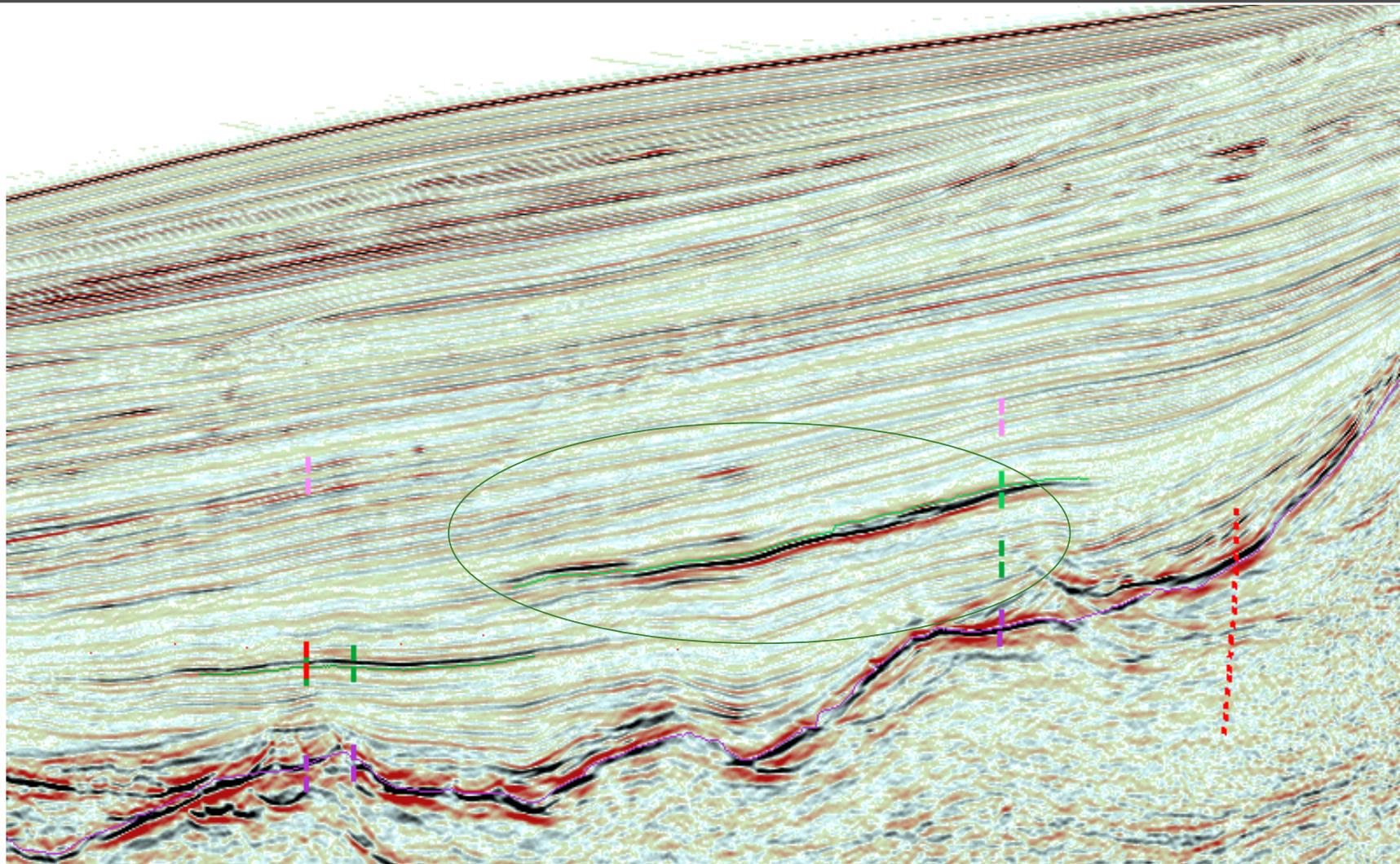
Reservoir geometries?



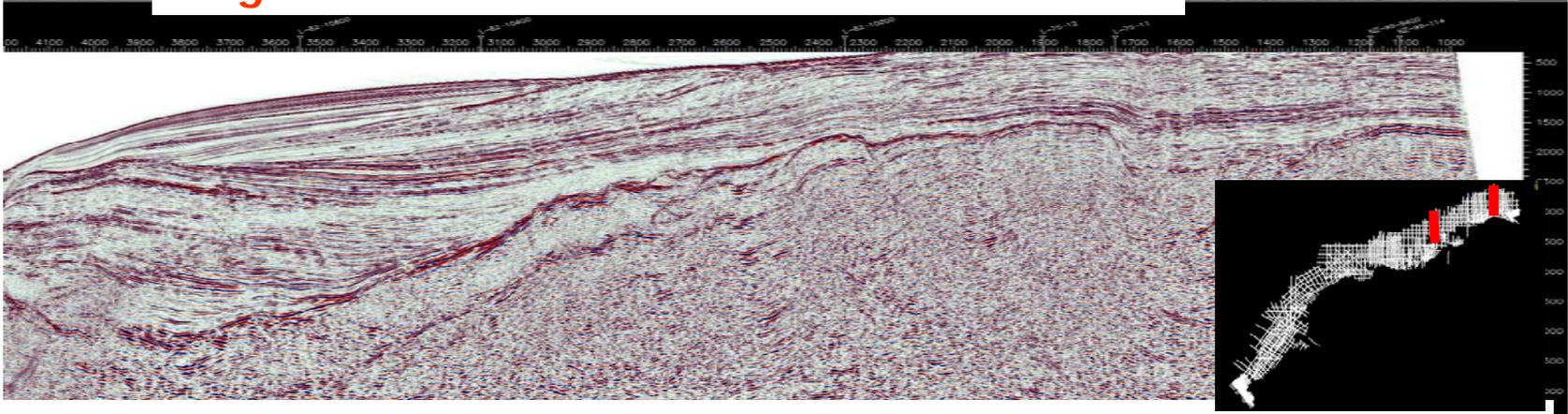
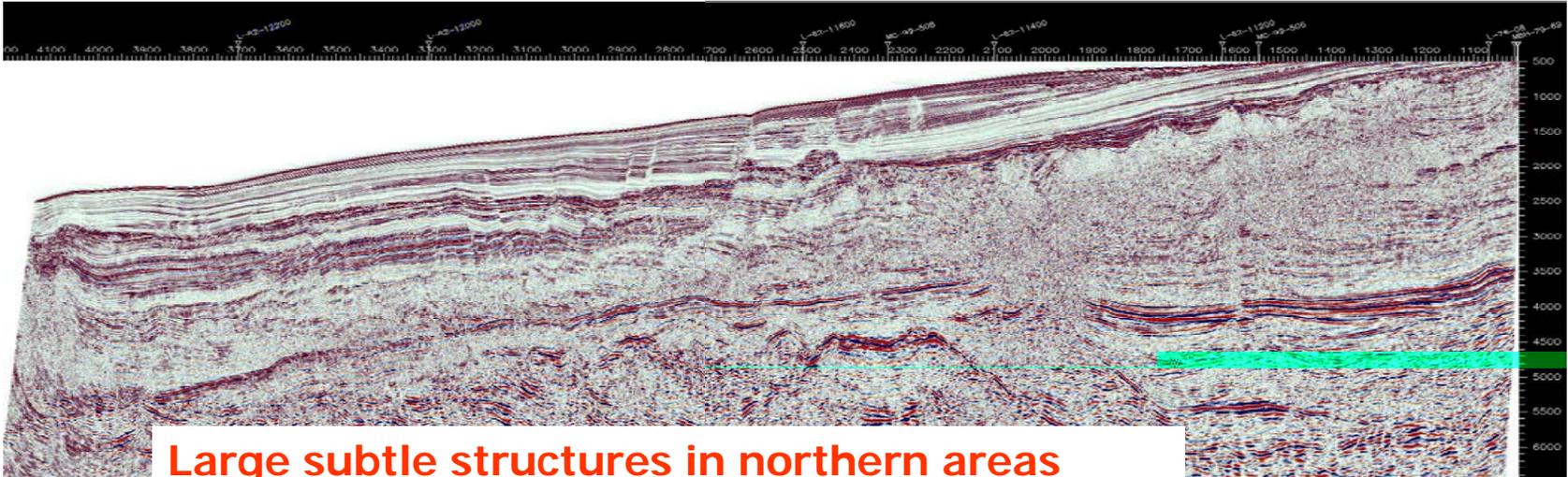
# Play Types: Compressional "Piggybacks"



# Play Types: Basin Floor Fans and Turbidite Systems



# Play Types: Additional Plays



**An unexplored fan delta, many sequence stratigraphic play types**

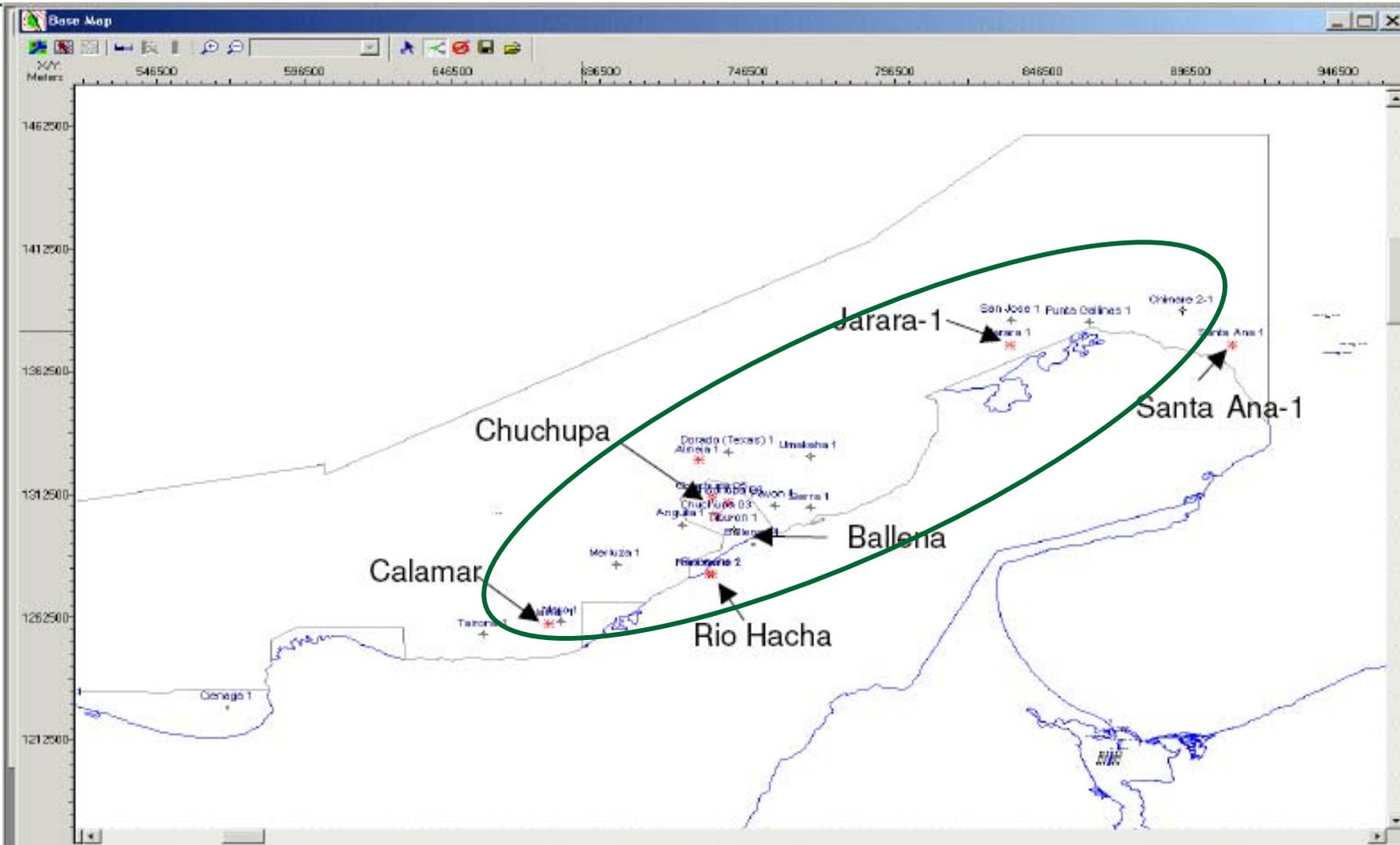


# Area Review



# Northern Area:

## Empirical Evidence for the Presence of Commercial Hydrocarbons



# Northeastern Area:

## Empirical Evidence of an Active Hydrocarbon System, 14 k km 2D

- Three Producing Gas Fields
  - Chuchupa – 5.7 TCF
    - Biogenic / Thermogenic mix
  - Ballena – 1.5+ TCF
    - Biogenic
  - Riohacha – <1 TCF
    - Biogenic
- Additional wells tested gas
  - Santa Ana
  - Jarara
  - Calamar
- Piston Core Data with Hydrocarbons

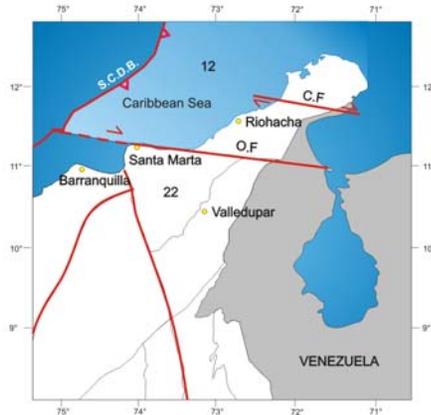
# Onshore – offshore basins, Northeastern Area

GUAJIRA OFFSHORE BASIN  
LOCATION AND BOUNDARIES



**BOUNDARIES**

North-Northwest: South Caribbean Deformed Belt deformation front (S.C.D.B.)  
 East: Colombia-Venezuela border  
 Southwest: Oca Fault (O.F.)  
 Southeast: Continental Guajira shoreline

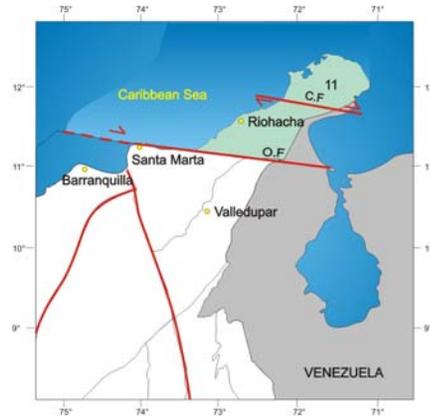


GUAJIRA BASIN  
LOCATION AND BOUNDARIES

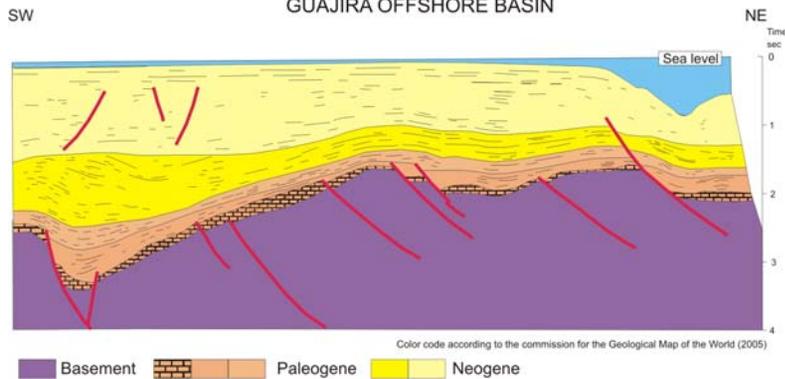


**BOUNDARIES**

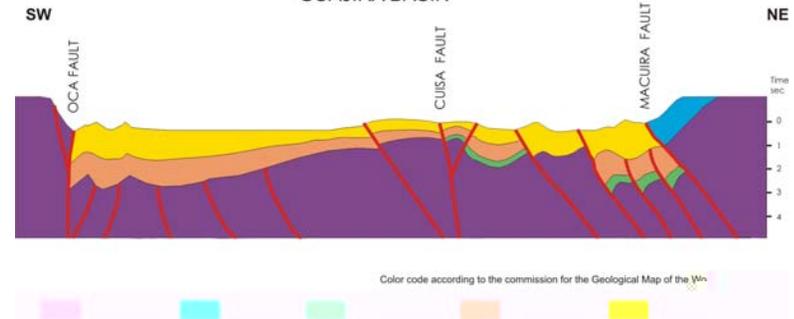
North and Northwest: Caribbean shoreline  
 Northeast: Caribbean shoreline  
 Southeast: Colombia-Venezuela border  
 South: Oca Fault (O.F.)



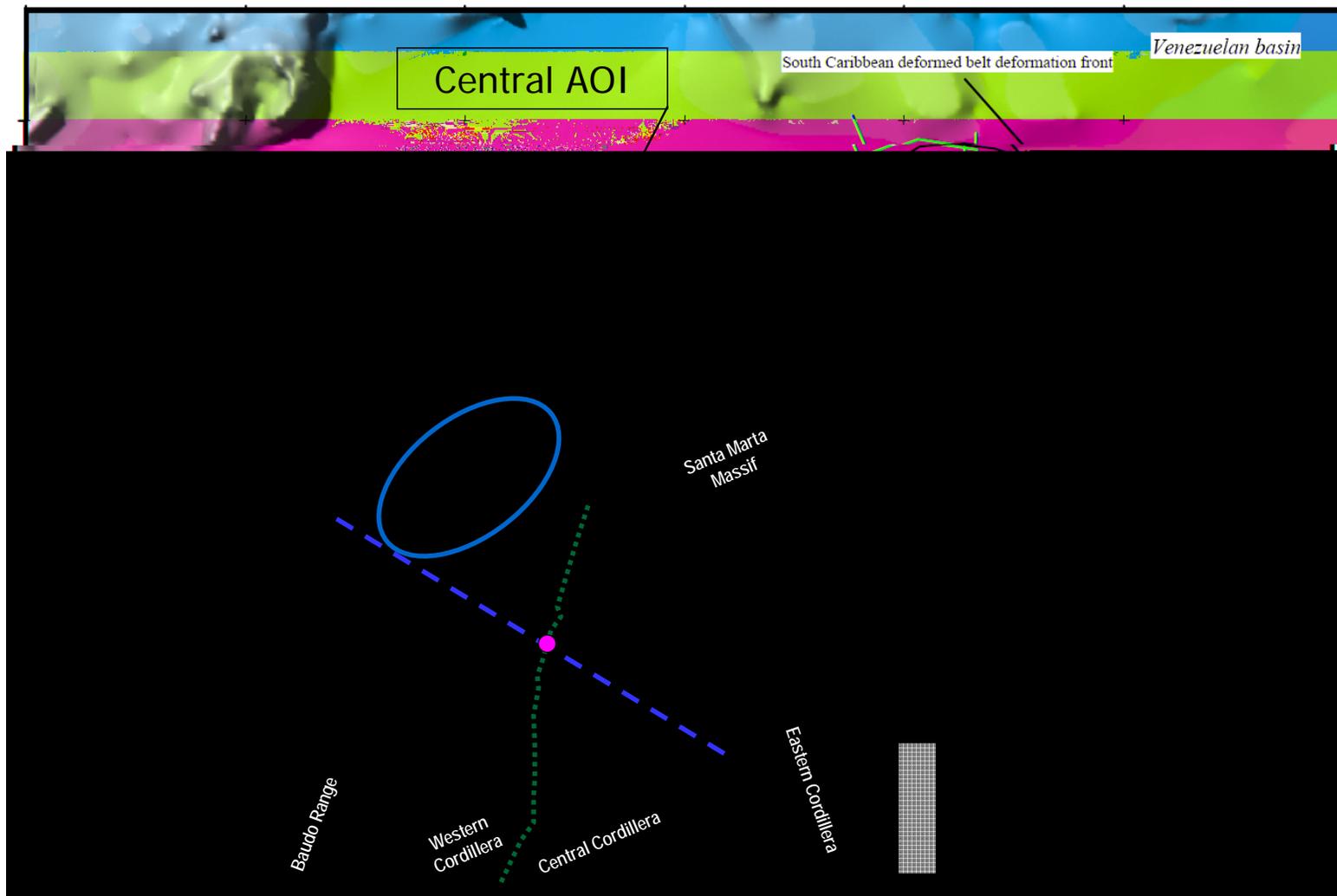
SCHEMATIC CROSS SECTION  
GUAJIRA OFFSHORE BASIN



SCHEMATIC CROSS SECTION  
GUAJIRA BASIN



# Central Area: Large Unexplored Basin Area



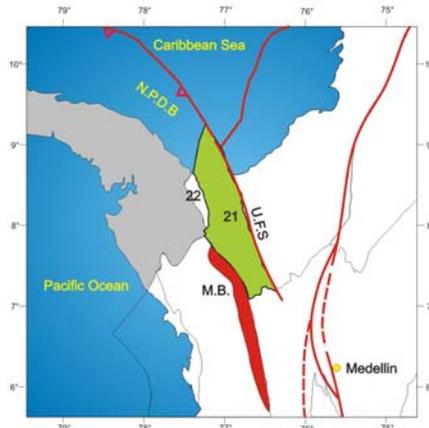
# Central Area:

## Significant Exploration Potential, 7 k km 2D

- Moderate amount of current data
  - Limited 2D seismic data base
- Minimal well control
  - Only three locations have been tested
    - Cartagena wells 1 through 4
      - Drilled 1976 to 80; 4mm cfg per day
    - San Diego-1
      - Drilled 1979 dry hole
    - Barranquilla-1
      - Drilled 1980, 1mm cfg per day
- Large undrilled fan deposit
  - Offshore Magdalena Fan untested in offshore in water depth of 200 meters or more
  - Initial exploration activity curtailed due to a lack of gas market

# Central & Southwest Areas: Piston Core and Bathymetric Evidence of Hydrocarbons

URABÁ BASIN  
LOCATION AND BOUNDARIES

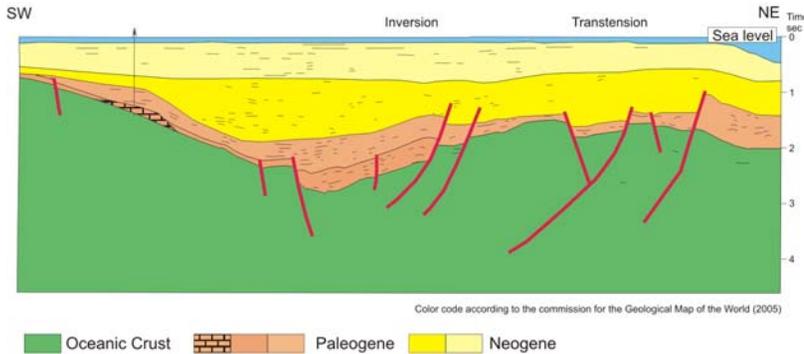


N.P.D.B. North Panama Deformed Belt

**BOUNDARIES**

- North: Colombian-Panamá Boundary
- East: Uramita fault system (U.F.S.)
- South: Cretaceous rocks of the Western Cordillera
- Southwest: Mandé batholith (M.B.)
- West: Serranía del Darien (22)

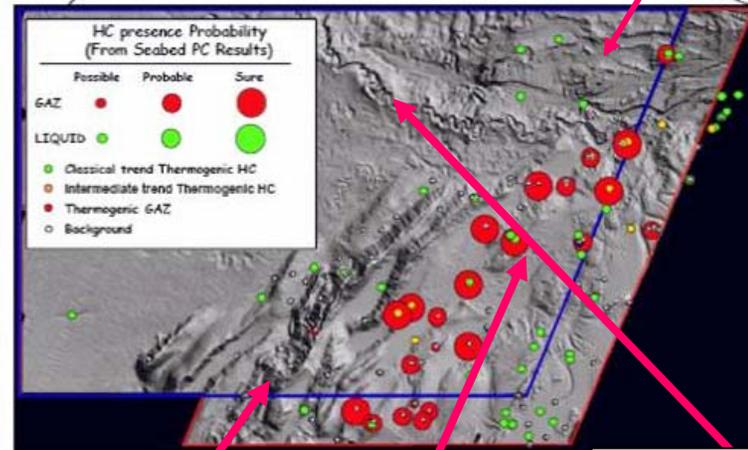
SCHÉMATIC CROSS SECTION  
URABÁ BASIN



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



Ancient Fan



Sea Floor Fault pattern

HC assoc. w/ sea floor faults

Submarine Channel Complex w/ assoc. Deep water fan



# Southwest Area:

## Significant Exploration Upside, 8 k km 2D

- Only six exploration wells drill in immediate area
  - Last well drilled in 1978
  - Drilling pre-dates majority of area's seismic
- Lack of exploration due to industry focus on oil
  - Colombia gas market satisfied with existing fields
  - Currently a large Caribbean and Atlantic coast gas market
- Piston Core Data
  - Predominately gas in the northern half
    - Biogenic / Thermogenic mix
  - Oil indications in the southern half
    - Primarily Tertiary biomarkers
    - Possibly both oil and condensate

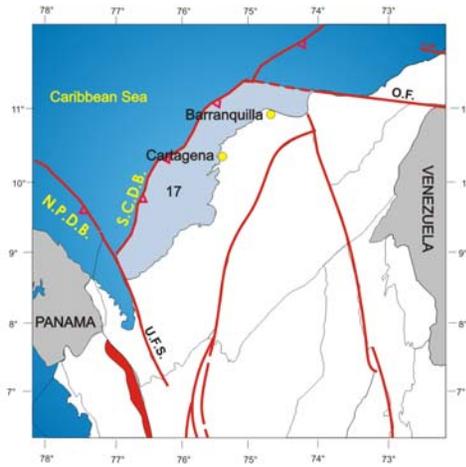
# Onshore – offshore basin, Southwestern area

SINÚ OFFSHORE BASIN  
LOCATION AND BOUNDARIES



**BOUNDARIES**

- Northeast: Oca fault (O.F.)
- Northwest: South Caribbean Deformed Belt deformation front (S.C.D.B.)
- Southeast: Present day shoreline
- Southwest: Uramita Fault System (U.F.S.)



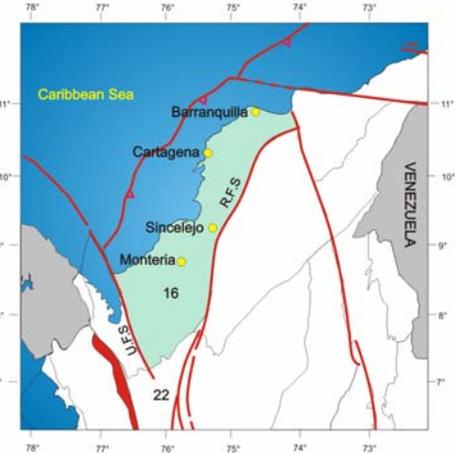
N.P.D.B. North Panama Deformed Belt

SINÚ - SAN JACINTO BASIN  
LOCATION AND BOUNDARIES

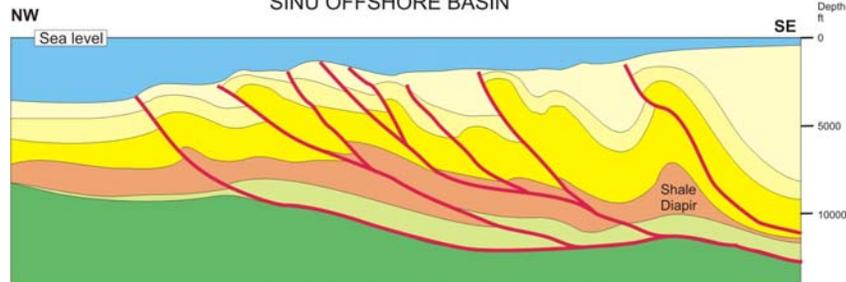


**BOUNDARIES**

- North-northwest: Present Caribbean coast
- East: Romeral fault system (R.F.S.)
- South: Cretaceous rocks (Western Cordillera; 22)
- West: Uramita fault system (U.F.S.)



SCHEMATIC CROSS SECTION  
SINU OFFSHORE BASIN

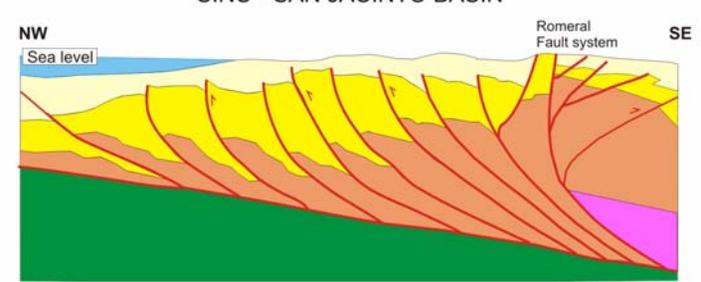


Modified from Amaral, et al., 2003.

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

- Oceanic Crust
- Upper Cretaceous
- Paleogene
- Neogene

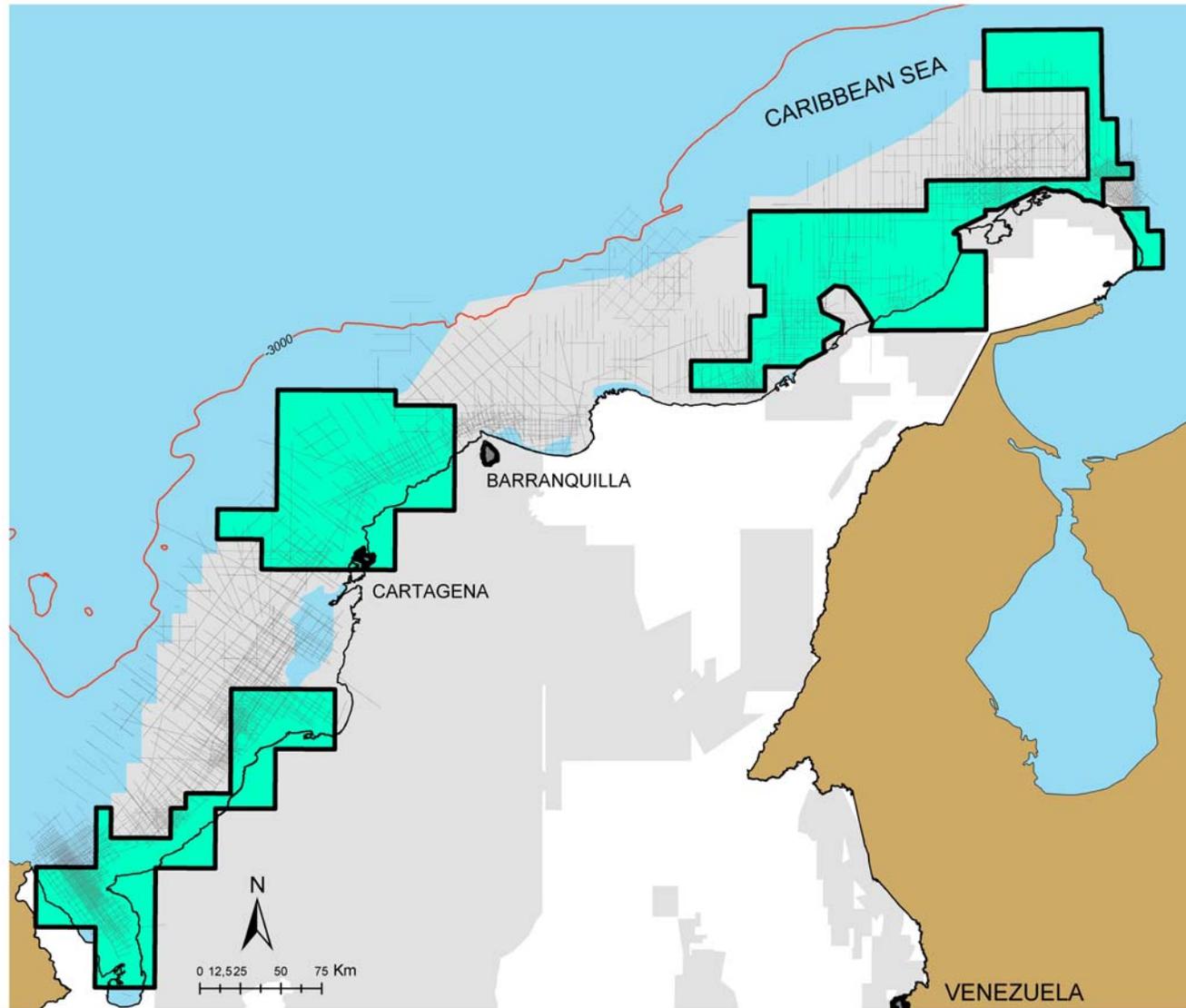
SCHEMATIC CROSS SECTION  
SINÚ - SAN JACINTO BASIN



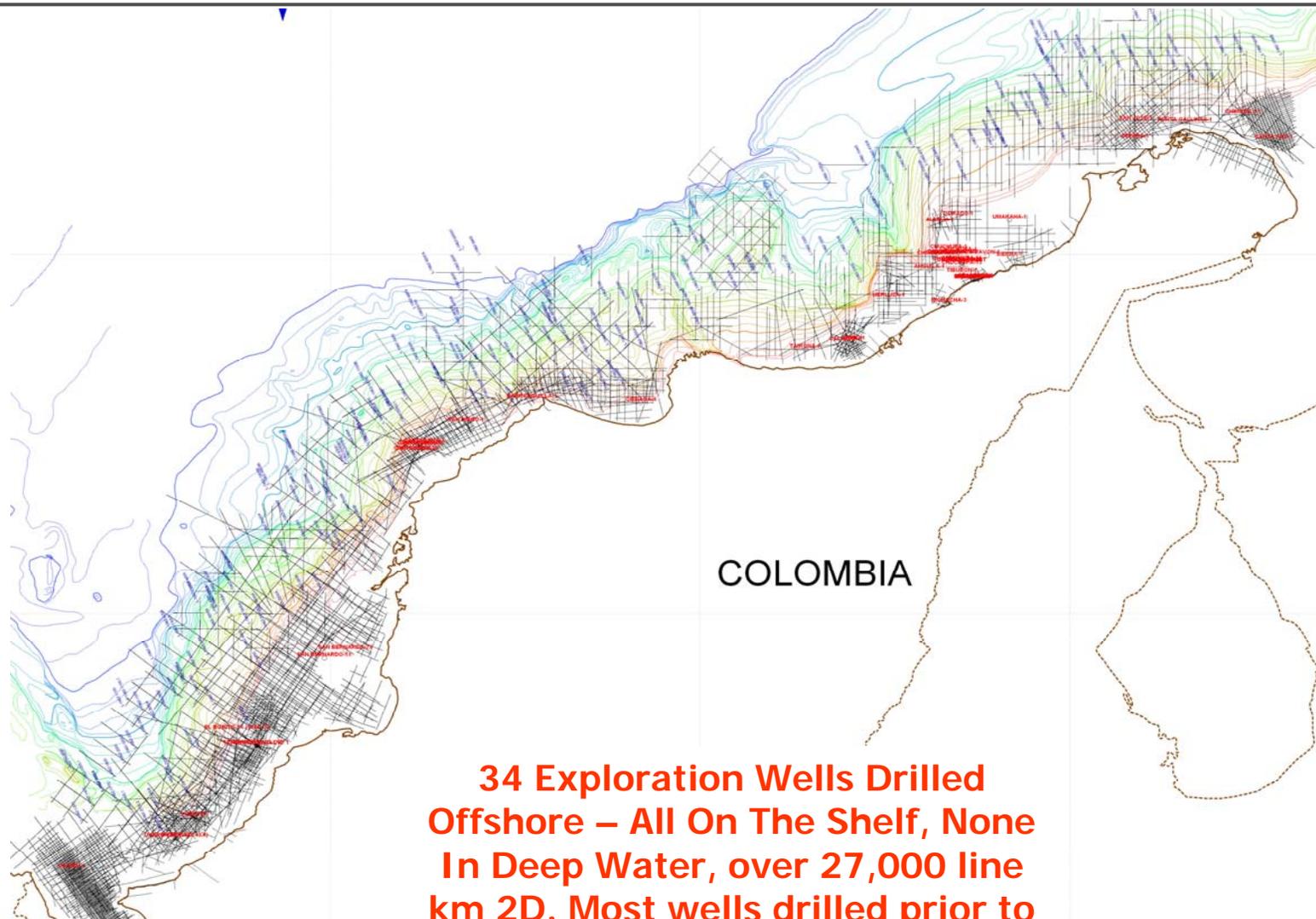
Color code according to the commission for the Geological Map of the World (2005)

- Oceanic Crust
- Continental Crust
- Paleogene
- Neogene

Data is available within all three areas



# Offshore Data



**34 Exploration Wells Drilled  
Offshore – All On The Shelf, None  
In Deep Water, over 27,000 line  
km 2D. Most wells drilled prior to  
seismic**

## ANH data package

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- 34 Wells
- 27,000 km of vintage offshore 2D data
- Onshore 2D data, km to be determined
- Data set to be available May 21, 2007 electronically

- Modern Spec Data
  - 3,500 km of GX Technology 2D data
    - Modern acquisition and processing of regional 2D lines
  - Two CGG Veritas 2D programs
    - 3,004 km Magdalena fan
    - 2,140 km Tayrona deep

# Work Commitments and Guarantees

## First Phase

Block	Type	Surface Area 1,000 hect.	2D km offshore equivalent
RC 1	Transition	407	1,600
RC 2	Transition	220	800
RC 3	Transition	346	1,400
RC 4	Deep	353	1,400
RC 5	Transition	269	1,000
RC 6	Deep	269	1,000
RC 7	Transition	235	1,000
RC 8	Shallow	277	1,200
RC 9	Transition	212	800
RC 10	Deep	268	1,000
RC 11	Transition	372	1,400
RC 12	Shallow	254	1,000
RC 13	Deep	317	1,200

# Conclusions:

## A Unique Exploration Opportunity

- Proven Petroleum System
  - Multiple gas fields already on production
  - Wells drilled in non-producing areas had gas shows
  - Drop core data indicates gas and/or oil in most areas
- Large under-/un-explored blocks
  - Large blocks with little or no previous exploration completed. Despite the frontier nature of the region, there is significant data available for proper evaluations and decision-making.
  - Current data set gives good indications for substantial traps
  - Variable exploration areas, shallow to deep waters.
  - New data allows a much better view of the area's prospectivity
- Minimal initial commitment
  - Phase I work program does not have a well commitment
  - Initial three year period to make a drilling decision

# Conclusions:

## A Unique Exploration Opportunity

- Timing

Large companies (ExxonMobil, Petrobras, BHP) are currently “breaking ground” in the Colombian Caribbean offshore. Once they open new plays, acreage will become very valuable. Today is a time of opportunity.



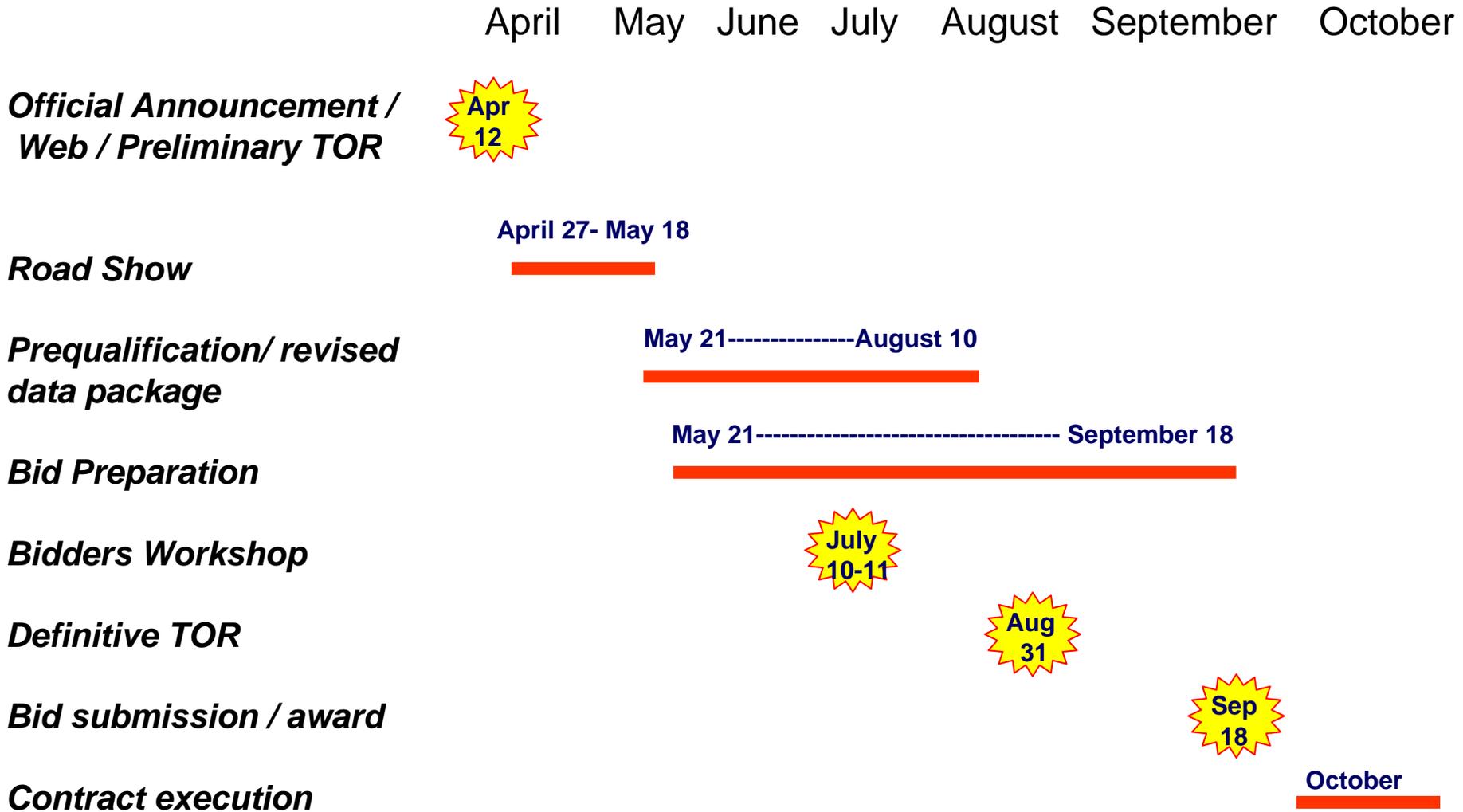
## Offering Process

**Bogotá - Houston – London –Singapore - Calgary**



- Two-stage selection
  - Technical, Legal and Financial Prequalification
  - Economic terms and Work program
  
- Data and information packages
  - All useable data available on the Blocks

# Timetable



# Participation requirements

- Payment of Participation Fee (all participants)
- Legal Qualification (all participants)
- Operational and Financial Qualification (Operators only)

- Qualification may include parent company
  - At discretion of ANH, very large companies may qualify with significant operating subsidiary
- Company must be capable of discharging all obligations under the E&P Contract
- Qualified company will provide a financial guarantee, and guarantee general performance under E&P Contract

- Submission requirements to demonstrate operational capacity are waived for companies that are cited as “top 100” oil companies, in the most recent edition of *Petroleum Intelligence Weekly*
- Other companies need to demonstrate
  - Oil equivalent, operated production levels in excess of 5,000 boe/d in 2006
  - For qualification of operatorship in deepwater blocks (per definition in TOR), an operated production levels in excess of 5,000 boe/d in depths in excess of 300m, in 2006
  - Evidence of Exploration and Production operations in frontier and environmentally sensitive areas

- Financial statement submission requirements are waived for companies that
  - Have outstanding securities ranked as “investment-grade” by credit rating agencies: Moody’s (Baa), Standard & Poors (BBB) or Fitch (BBB); or
  - Are cited as “top 100” oil companies in the most recent edition of *Petroleum Intelligence Weekly*
  
- Qualification for other companies:
  - Operator of blocks designated “Deepwater” in TOR
    - Minimum of US\$ 4 billion of market capitalization, or
    - Minimum of US\$ 2 billion of Shareholder Equity
  - Operator of other blocks
    - Minimum of US\$ 2 billion of market capitalization, or
    - Minimum of US\$ 1 billion of Shareholder Equity

- Companies have to submit to the ANH the financial information forms, as included in the Terms of Reference
- Forms signed by legal representative of Participant
- Information certified by a public accountant or external auditor

# Legal qualification documentation (all participants)

- Constituent documents (By-Laws, Articles of Incorporation, etc)
- Designation of properly empowered Legal Representative
- Affidavits attesting to non-existence of any material legal judgment, commitment to transparency
- Documents must be officially translated and formalized

- Key documents must be notarized except where otherwise indicated
- Key documents from outside Colombia must be consularized or have an “apostille”
- Documents must be in Spanish
  - Certain documents may be submitted in original language with an official Spanish translation

# Submission of qualification documentation

- Submissions accepted until August 10, 2007
  - Evaluation of submissions completed on first-come, first-served basis – Notification as soon as possible thereafter
  
- Preliminary list of qualified companies will be published on the web on August 24th
  
- Official list of qualified companies will be published on the web on September 7th

- Payable by each Company participating in the Caribbean Round
  - All companies in consortia must pay participation fee individually
  - US\$ 150,000 (US\$ 130,000 if company had previously purchased the data package from EPIS)
  
- Entitles Company to:
  - Bid on appropriate blocks, after passing qualification stage
  - Receive the updated Information Package after May 21

- Qualified companies free to form consortia, or temporary unions, up to point of bidding
  
- Subject to:
  - Having a qualified Operator
  - Operator must hold at least 30% interest

- 2 day workshop to review different aspects of the offering
  - Opportunity for more detailed discussion of certain aspects, e.g. contract, permitting and environmental regulations, gas market, tax, etc.
  - Provisionally scheduled for July 10-11 in Bogotá
  
- Open to companies that have acquired the data package from either ANH directly or through EPIS

- If appropriate, incorporates participant's comments
- Publication of adjusted TOR, scheduled for August 31, 2007
- Only minor adjustments are expected, and additional detail on
  - Time, place and date for bidding and award ceremony
  - Order of bidding for the Blocks
  - Bid Evaluation criteria

- Public ceremony
- Blocks to be offered sequentially
- Results from one bid will be known before next due
- A Bid Bond must accompany each bid

- All bids will have an explicit undertaking to accept, without exception, the Definitive Terms of Reference
- Non-complying bids will not be opened or considered
- Bids will be evaluated upon opening, and results announced immediately
- Bids will comprise
  - An additional participation for ANH (X%), main evaluation factor
  - An commitment for exploratory work in addition to the Minimum Work Program for the relevant block, which will be used for a tie breaker
- The criteria for the evaluation of the bids will be provided in the Definitive Terms of Reference

- Bid Guarantee: Standby Letter of Credit in the amount of US\$ 5MM, to secure winning Bidder's obligation to sign the E&P Contract
  
- Bid Guarantee replaced by Letter of Credit for Minimum + Additional Work Program, no later than 15 days after E&P Contract signature
  - Minimum Exploratory Program specified in TOR should be guaranteed 100%
  - Additional Exploration Program guaranteed 50%
  - Compliance of the Minimum and Additional Exploratory Programs is based on its physical execution
  
- If subsidiary signs the contract, a general letter of guarantee of performance from parent company will be needed

- To be executed as soon as possible after award
- Requires company incorporated in Colombia for contract execution.
  - Companies not already incorporated in Colombia have 60 days to establish a local company to perform the Contract
- Contract may be signed by affiliate of qualified company
  - Additional documentation required
  - Qualified company still provides general performance guarantee

- E-mail: [preguntas@caribbeanround2007.com](mailto:preguntas@caribbeanround2007.com)
  - Simple queries - dealt with directly
  - More complex queries - posted on website
  
- Bidders workshop
  - Only for companies who have acquired EPIS data package
  - Provisional dates July 10-11, 2007
  
- Contact Ronda Caribe Office
  - [www.caribbeanround2007.com](http://www.caribbeanround2007.com)

**Website:** [www.caribbeanround2007.com](http://www.caribbeanround2007.com)  
[www.rondacaribe.com](http://www.rondacaribe.com)

- All information pertinent to Round
- Regularly updated, containing:
  - Initial and Definitive Terms of Reference
  - Block Maps
  - Basic Round Information / Schedule
  - Relevant legislation
  - FAQs
  - Links to ANH main web-site and information on E&P activity in Colombia

-  Anuncio Oficial de la Ronda Caribe 12-04-2007
-  Official Announcement Caribbean Round 12-04-2007
-  Registration Form | Formulario de Registro
-  Términos de Referencia

# Caribbean round 2007



| [www.caribbeanround2007.com](http://www.caribbeanround2007.com) |



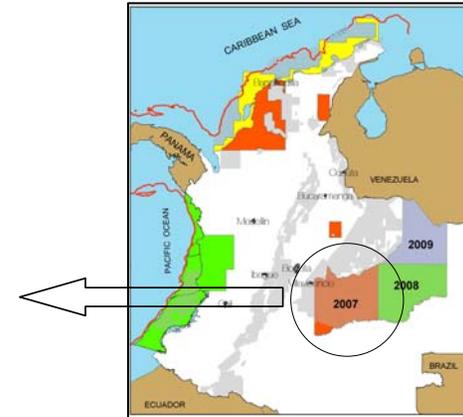
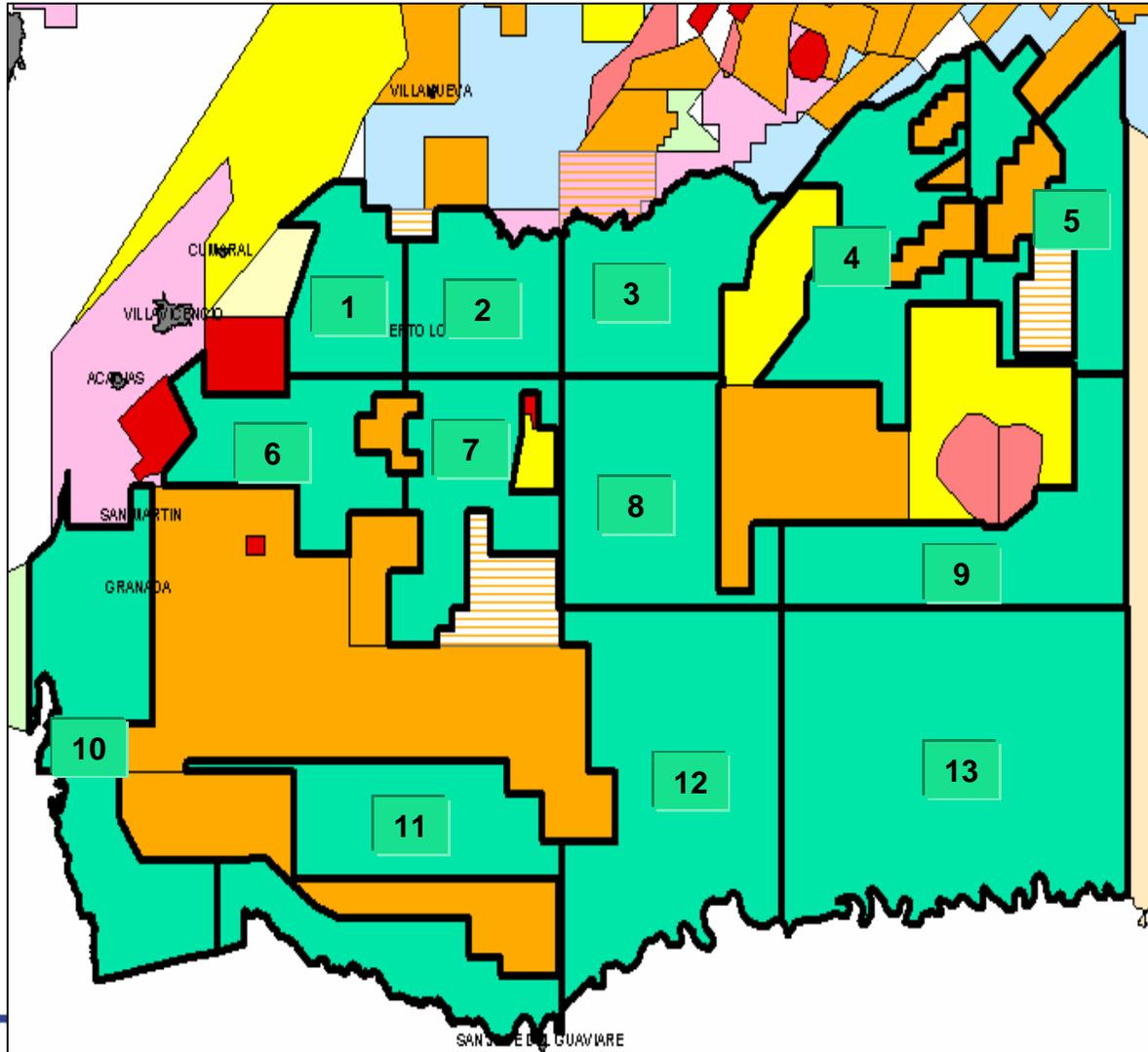
## Investor selection process for heavy oil development

**Bogotá - Houston – London –Singapore - Calgary**





# Proposed blocks (preliminary):



BLOQUE	CUENCA	Area (Ha)
RCP 1	LLA	133,778
RCP 2	LLA	164,962
RCP 3	LLA	221,663
RCP 4	LLA	245,472
RCP 5	LLA	222,364
RCP 6	LLA	181,168
RCP 7	LLA	199,270
RCP 8	LLA	276,712
RCP 9	LLA	268,783
RCP 10	CAG-VAU	333,943
RCP 11	CAG-VAU	372,072
RCP 12	LLA	466,727
RCP 13	LLA	719,884

## Resource potential

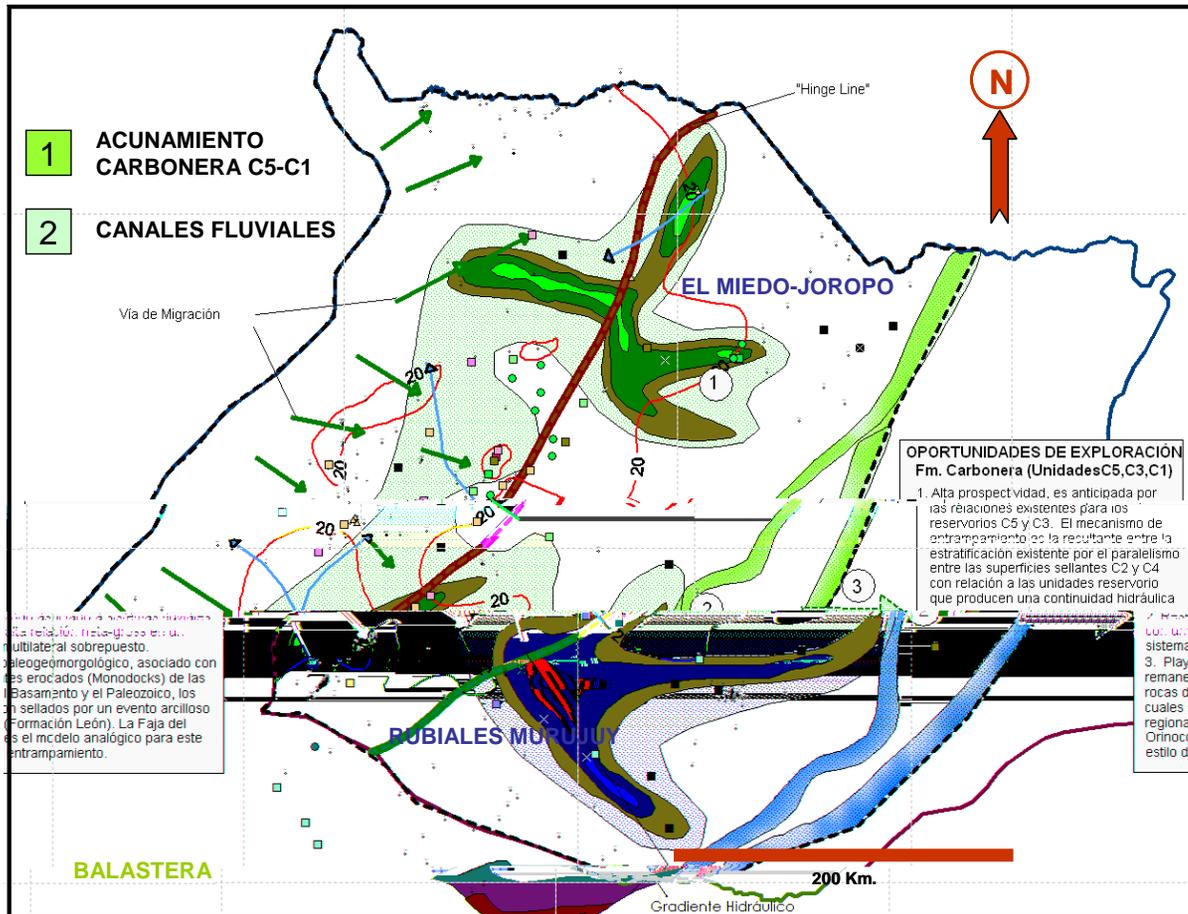
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Results of Halliburton study (2006)

*“Comprehensive study for the calculation of proven and probable reserves of crude oil with an API gravity of less than 20 API degrees in the Llanos Orientales basin”:*

- P10 = 2,100 MMbbls
- P50 = 4,400 MMbbls
- P90 = 8,300 MMbbls
- 41 areas of interest
- 5 stratigraphic units
- Truncations, pinchouts, fluvial channels

# Potential areas from paleozoic pinchout and fluvial channels



Formation	MMbbls (P90)
C 7	5,405
Mirador	1,977
Guadalupe	331
Une	33
C 5 - C 1	560
<b>Total</b>	<b>8,300</b>

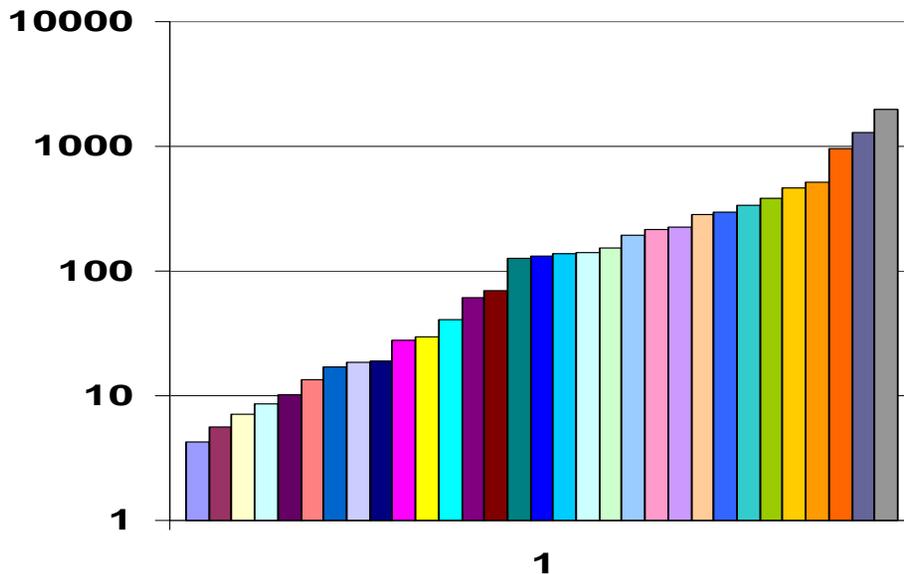
Source: Halliburton, 2006

# Risked undiscovered volumes of oil in situ: 8,300 to 15,100 million barrels (P90 - P99)



could be found in stratigraphic traps, especially lateral terminations of productive units, fluvial channels and sandstones on flood plains:

## Potential (MMBO)



## Plays

(A)W-Cachama UNE	(A)AOI 5 GUADALUPE
(A)AOI 4 GUADALUPE	(A)AOI 1 Norte MIRADOR
(A)AOI 2 UNE	(A)AOI 1 Norte GUADALUPE
(A)AOI 3 C7	(A)AOI 1 Norte C7
(A)AOI 3 Sur UNE	(T)Total (Truncaciones) GUADALUPE
(A)AOI 4 Sur MIRADOR	(A)AOI 3 GUADALUPE
(A)Total (Pinchamiento) C5	(A)AOI 2 GUADALUPE
(A)AOI 2 C7	(A)AOI 3 MIRADOR
(CF)Area 5 MIRADOR	(A)AOI 4 C7
(A)AOI 2 MIRADOR	(CF)Area 1 MIRADOR
(CF)AOI 1 Norte C1-C3-C5	(A)AOI 5 Sur C7
(CF)AOI 2 Sur C1-C3-C5	(CF)AOI 1 Norte C7
(CF)Area 4 MIRADOR	(CF)AOI 5 Sur C7
(CF)Area 3 MIRADOR	(CF)Area 2 MIRADOR
(CF)AOI 2 C7	(CF)AOI 3 C7
(CF)AOI 4 C7	

# Proposed selection process

1. Invitation to submit expression of interest
2. Short list selection
3. Data Package/Report Availability
4. Request for proposals
5. Direct negotiation
6. Selection by independent panel of experts