ONSHORE GUAJIRA BASIN

High potential lightly explored basin

Colombia

2005

2006

Petroleum System

The Onshore Guajira Basin: Covers an area of 12,600 km² (3,110,000 acres) is located in the northermost part of Colombia. The Lower Guajira Basin is the result of a releasing stepover of Cuisa–Oca transcurrent fault systems, thus generating a transtensional basin. North of the Cuisa fault, the Upper Guajira is structurally related to rifting that occurred north of Maracaibo lake. Exploratory drilling started with the Rancheria-1 well, spudded in 1948. To date, only 18 wildcats have been drilled with two gas fields discovered. The Ballena and Riohacha fields, with reserves of 1,315 and 86.5 of GCFG. Drilling density is 695 km²/well (172,000 acres/well).

Hydrocarbon evidence: Proven by the two gas fields discovered in the basin. Turbiditic sandstones with average porosities of about 17%.

Reservoirs: Siliciclastics and Carbonates are important reservoirs in the basin. Neogene limestones of the Uitpa and Jimol formations, with average moldic porosity of up to 20% and net pay thickness up to 100 ft. In addition, fractured basement can also be considered as a potential reservoir. (e.g. Venezuela, La Paz-Mara fields).

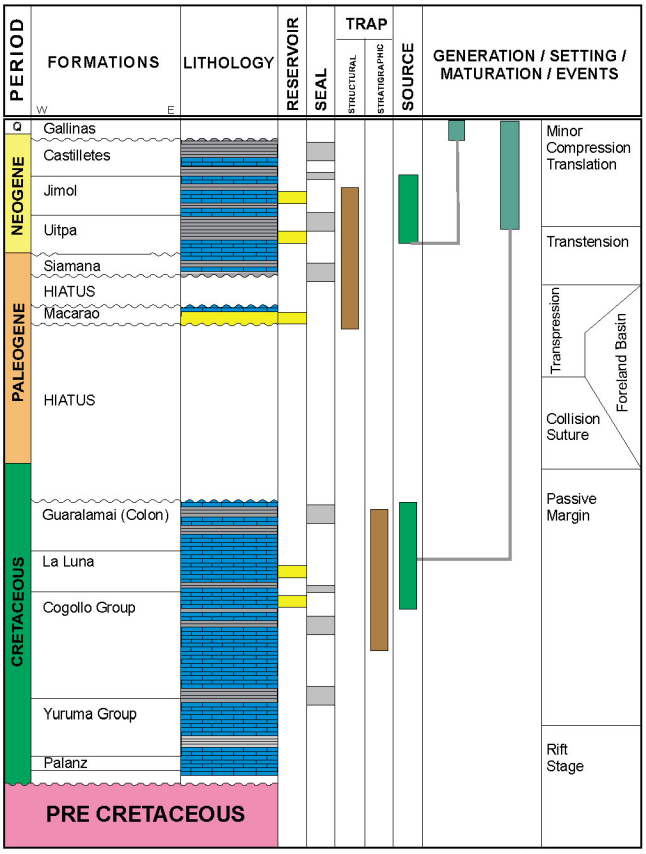
Traps: Several potential structural traps of Neogene age are the result of deformation generated by the Cuisa and Oca faults. Main stratigraphic traps are onlaps and truncations against basements highs. Carbonate mounds are very important trapping geometries.

Sources: Cretaceous Colon, La Luna and Cogollo shales contain kerogen type II and are considered good oil source rocks. Organic matter of Paleogene-Neogene source rocks is strongly gas-prone. The Neogene Castilletes formation has TOC values ranging from 1.5-2.0 % and kerogen type II and III.

Seals: Top and lateral seal for Cretaceous reservoirs in the Guajira is adequate where Paleocene and lower Eocene shales are present. Bed seal for Paleogene-Neogene reservoirs is variable.

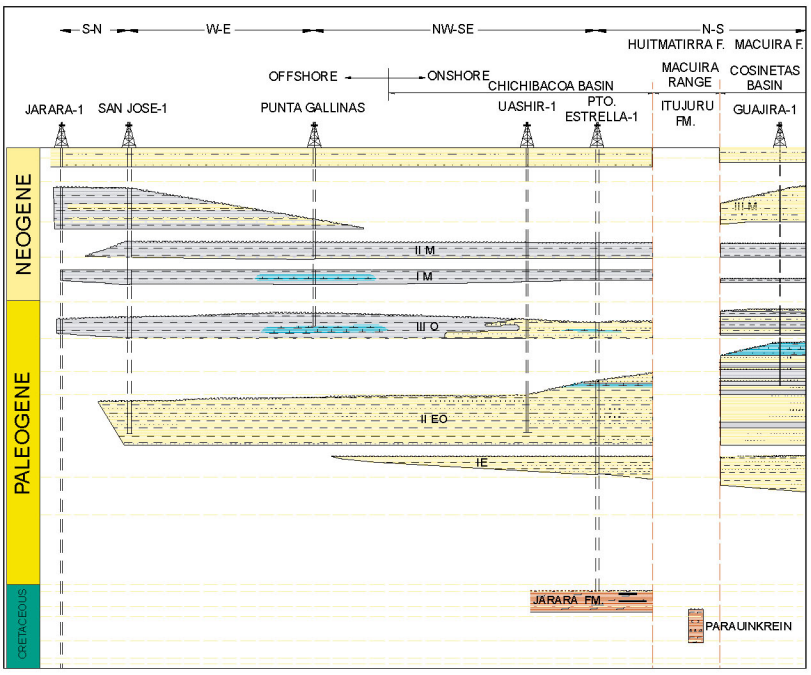
Migration and Timing: Most of the structures were formed during Late Paleogene-Early Neogene. Secondary migration of hydrocarbon most likely occurred soon after the first phase of structuring by Late Neogene.

Petroleum System Chart



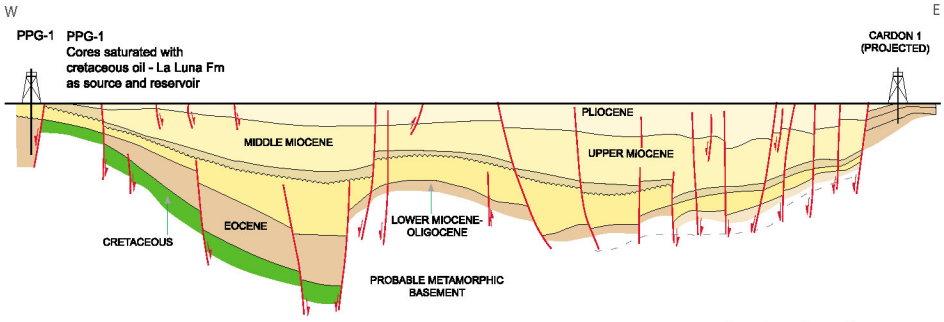
Geoconsult, 2005

Chronostratigraphic Chart



Modified from Mora, 2000

Regional Structural Cross Section

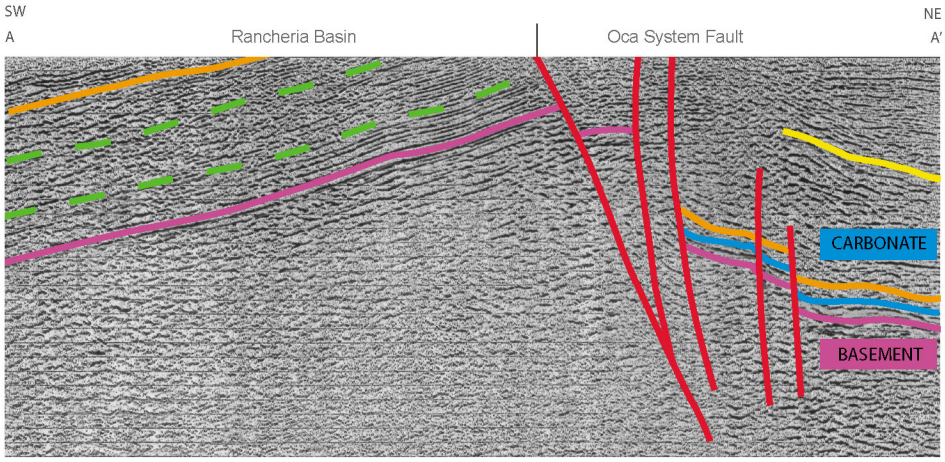


From: http://www.ihsenergy.com

Geoconsult, 2005

Fracture Carbonate Play

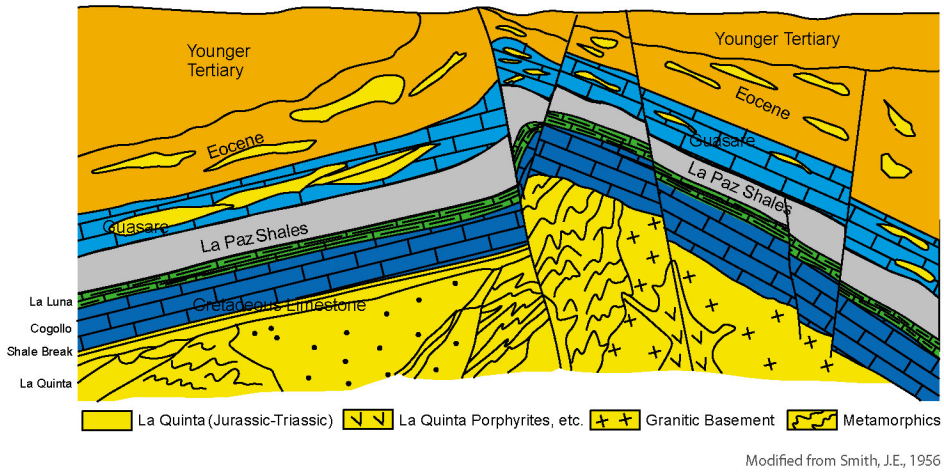
OLIGOCENE CARBONATES STRONGLY
FRACTURED BY THE OCA WRENCH SYSTEM



From Barrero, D., 1998

Analog Example

FRACTURE CARBONATE AND BASEMENT PLAY
(VENEZUELA, LA PAZ OIL FIELD)



Modified from Smith, J.E., 1956

Prospectivity

The PGG-1 Well (Venezuela) drilled carbonates of La Luna formation saturated with oil, thus documenting the existence of a hydrocarbon system in the south-eastern corner of the Upper Guajira. The generation pod is located to the east of the well in the Cosinetas basin. Highly prospective structural traps exist in the western flank of the Cosinetas basin in the Upper Guajira. Structural and stratigraphic traps in the Lower Guajira have good exploration potential.

Oligocene carbonates, fractured by the Oca wrench system, are the main exploratory target.

Proved Plays: Lower Miocene sandstones and limestones and Middle Miocene turbidites.

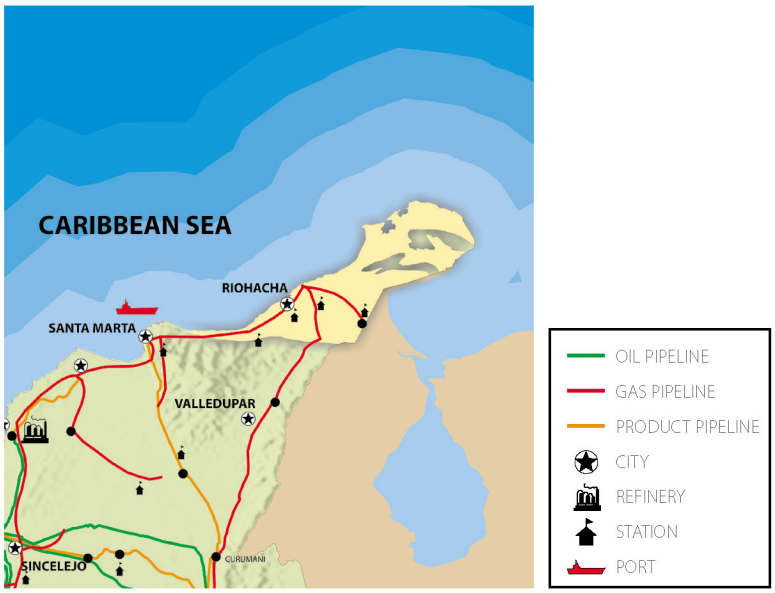
Unproved Plays: Wrench-Related structures associated to Cuisa and Oca faults. Onlaps and truncations. Imbricated thrust sheets and Oligocene carbonate stratigraphic plays.

Analog Example:

La Paz and Mara fields in western Venezuela. Oil is found in Cretaceous fractured limestones of the La Luna and Cogollo formations (recovery factor of 45%). Hydrocarbons are also found in faulted basement rocks as well as in metamorphic and igneous fratured basement.

Basin Location

Infrastructure



HIGHLIGTHS

Basin Type

Extensional basin by a releasing overstep of a lateral wrench system

2D Seismic Shot

1,700 km

Wildcats Drilled

18

Area

12,600 km²

3,110,000 acres

Coverage

695 km² /well

Hydrocarbon Type

Dry Gas

Number of Discoveries

2. Ballena and Riohacha fields: 1,315 and 86.5 GCFG

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Ecopetrol S.A.

Libertad y Orden

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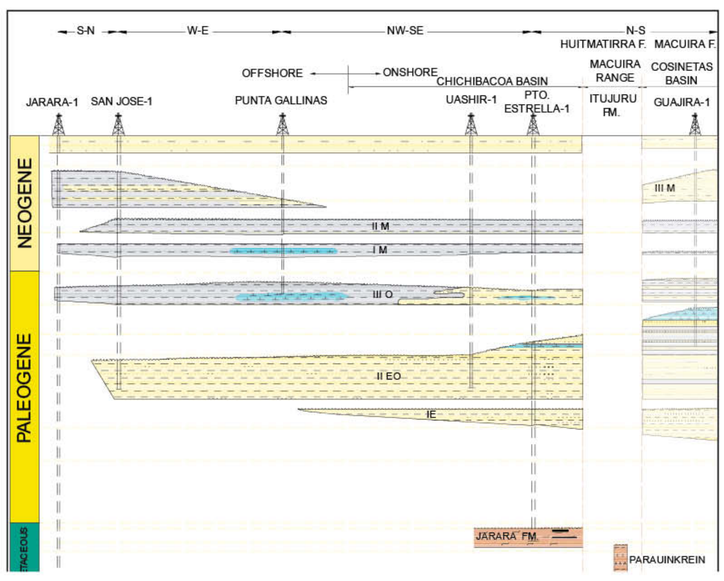
Guajira Basin - Onshore

High potential lightly explored basin

Wildcats and Oil Fields

ECOPETROL 1996

Chronostratigraphic Chart



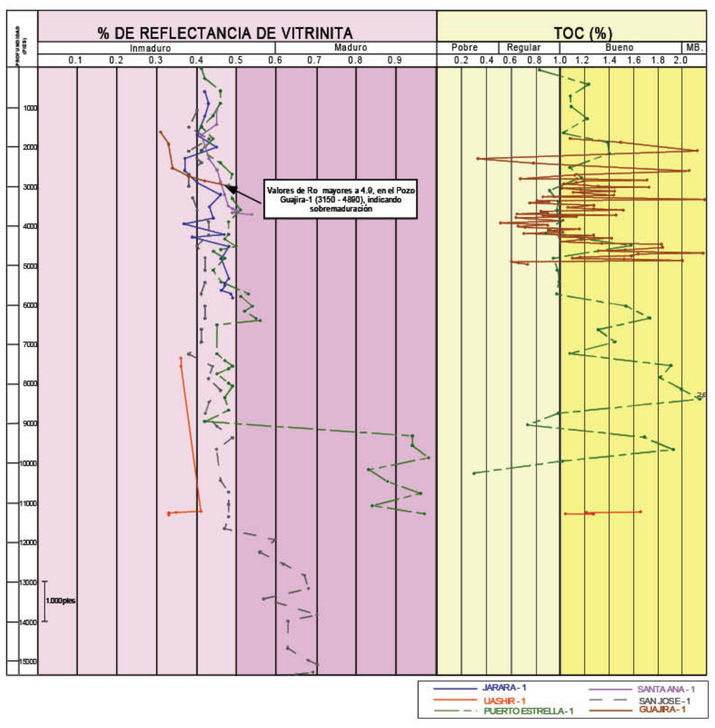
Modified from Mora, 2000

Highlights

Basin Type	Extensional basin by a releasing overstep of a lateral wrench system
2D Seismic Shot	1,700 km
Wildcats Drilled	18
Area	12,600 km2
	3,110,000 acres
Coverage	695 km2 /well
Hydrocarbon Type	Dry Gas
Number of Discoveries	2. Ballena and Riohacha Fields: 1,315 and 86.5 GCFG

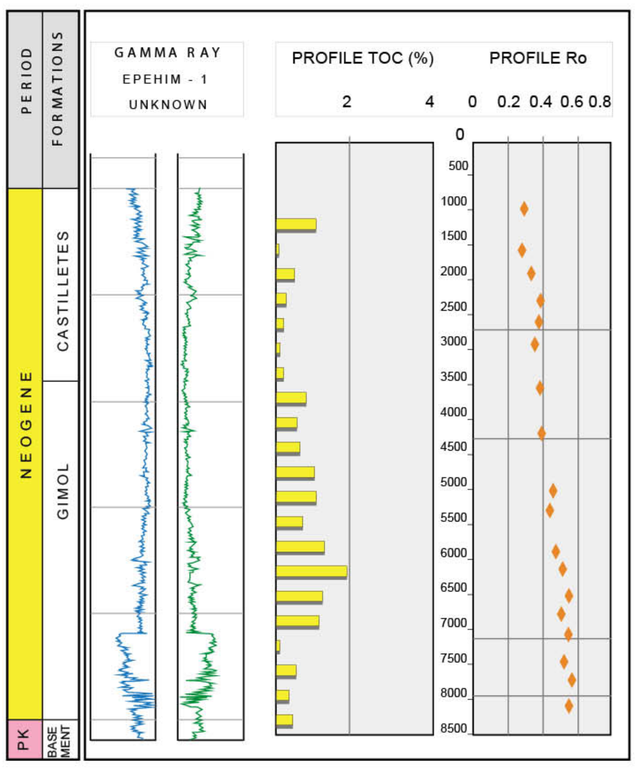
Geochemical Data

%Vitrinite Reflectance and Total Organic Carbon
UPPER GUAJIRA



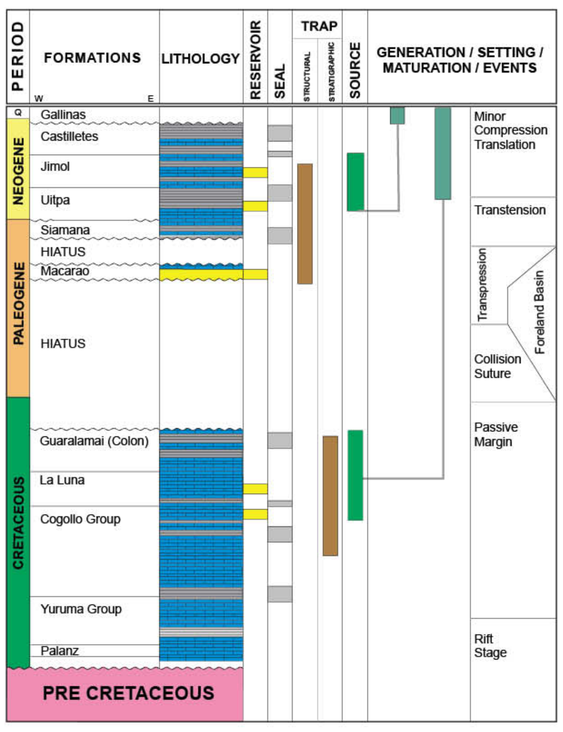
I.C.P., 1999

EPEHIN-1 WELL



ECOPETROL, 1999

PETROLEUM SYSTEM CHART

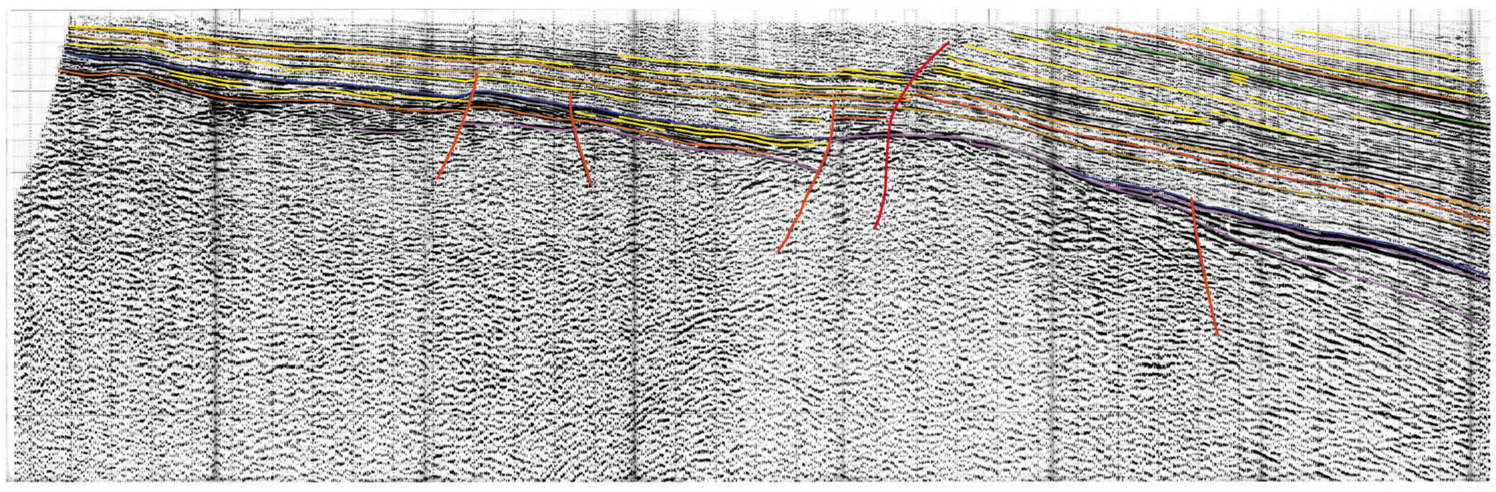


Geoconsult, 2005

Structural and Stratigraphic Plays

Line 1.

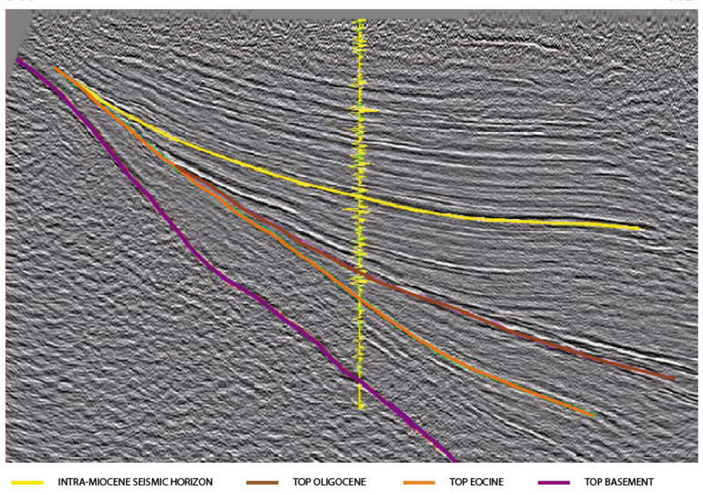
NW SE



From Roberson, L., 1992

Line 2. Stratigraphic Onlap Onshore CHIMARE AREA

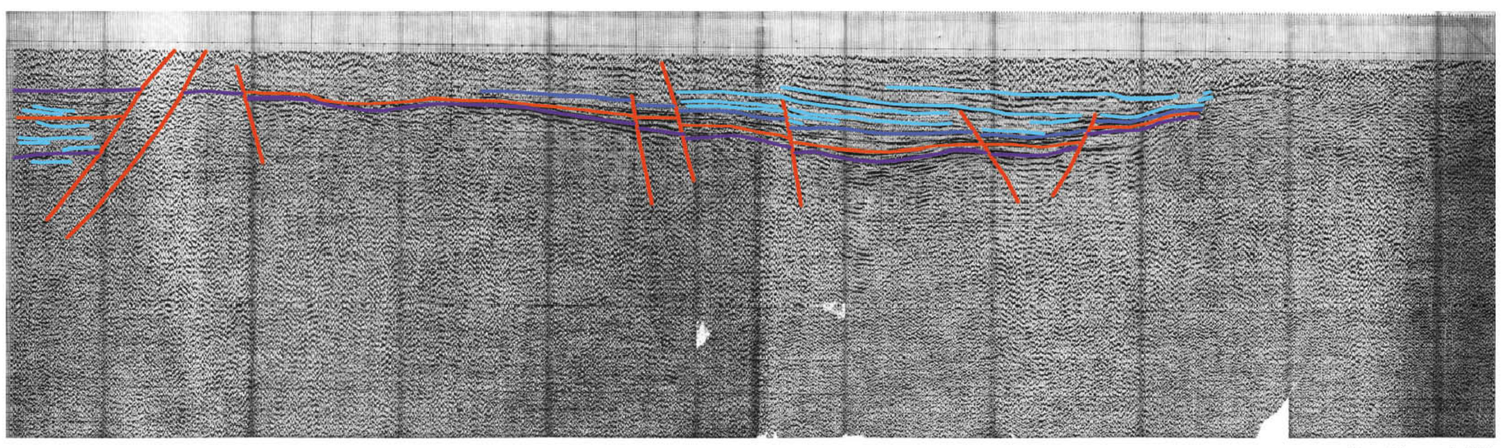
SW NE



From Ecopetrol, 1999

Line 3.

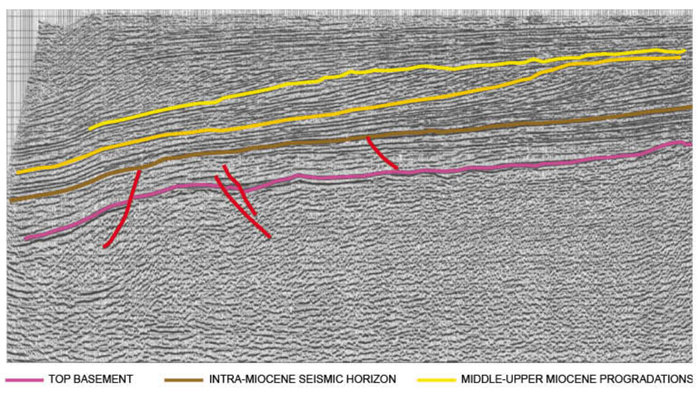
SW NE



From Roberson, L., 1992

Line 4. Middle Miocene Turbidites

W E



From Ecopetrol, 1999

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Agencia Nacional de Hidrocarburos
República de Colombia
Libertad y Orden

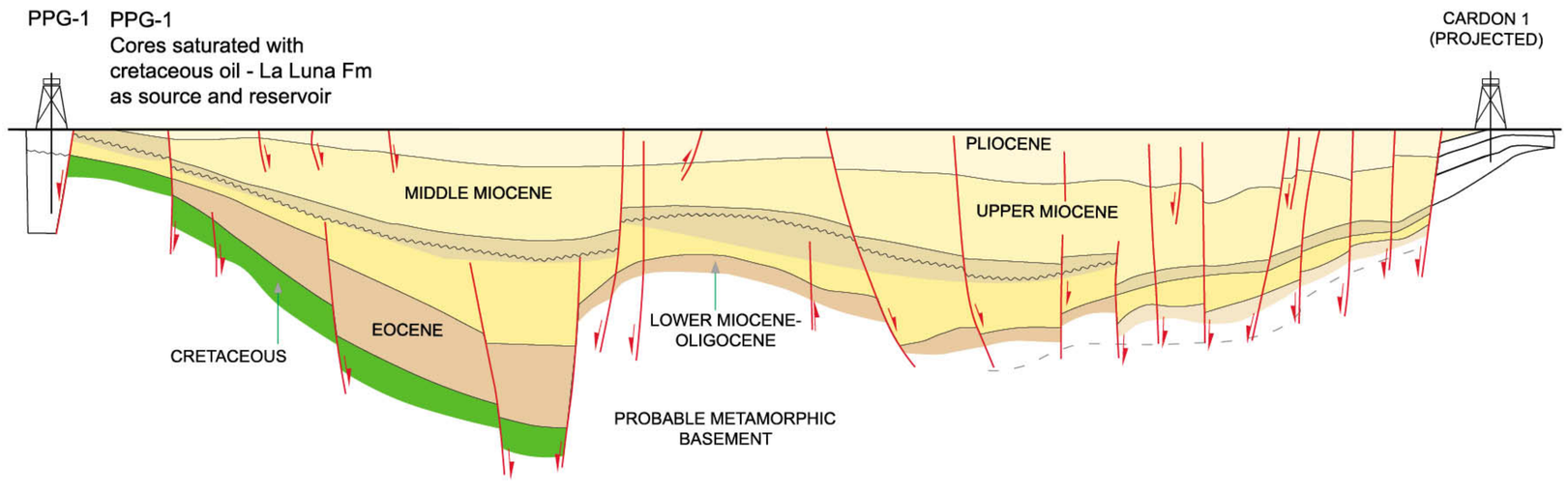
Colombia 2005 2006

Guajira Basin - Onshore

High potential lightly explored basin

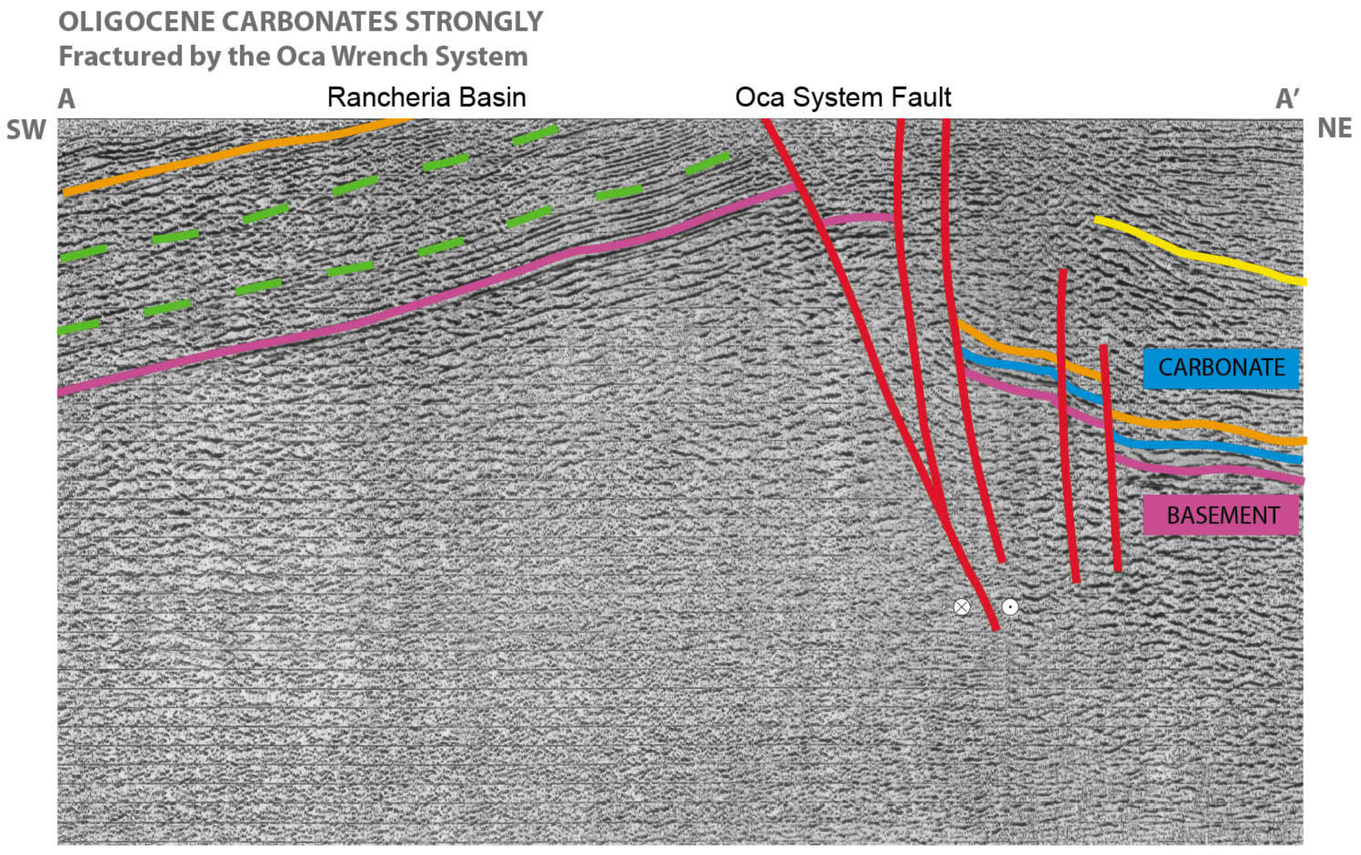
Regional Structural Cross Section

PGG-1 Well located in Venezuela, drilled on carbonates of La Luna formation , documenting the existance of a hydrocarbon system in the South eastern corner of the upper Guajira. Kitchen is to the east of the well.



http://www.ihsenergy.com

Fracture Carbonate Play



From Barrero, D., 1998

Play Types

Proved Plays

- **Lower Miocene Sandstones and Limestones.**
- **Middle Miocene Turbidites**

Unproved Plays

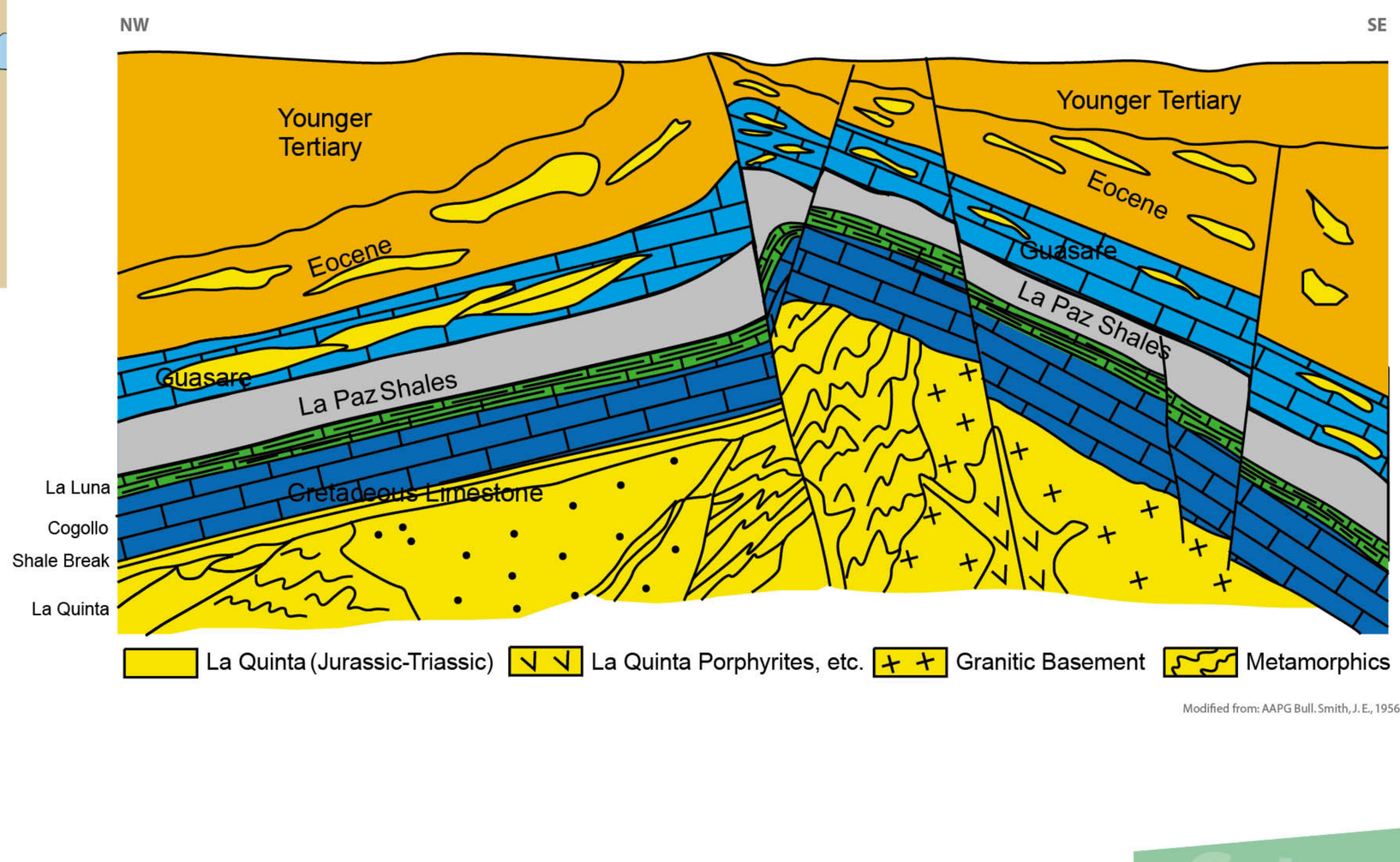
- **Wrench-Related Structures Associated to Cuisa and Oca Faults**
- **Onlaps and Truncations**
- **Imbricated Thrust Sheets**
- **Oligocene Carbonate Stratigraphic Play**

Analog Example

La Paz oil field of Western Venezuela is a super giant oil producer from fracture carbonates and granitic basement.

Fractured Carbonates and Basement play

LA PAZ OIL FIELD



Modified from: AAPG Bull. Smith, J. E., 1956

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