New Exploration Traps in the Espino Graben, Eastern Venezuela Basin*

Yoasmali A. Barrios[1], Noelia Baptista[1], and Grover Gonzales[1]

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[1]Exploration, PDVSA, Puerto La Cruz, Venezuela (yoasmaly@gmail.com)

Abstract

The Espino Graben has an area of 50,000 Km^2, its axis has a N60°E direction. The Pre-Cretaceous sedimentary thickness exceeds 20,000 feet, practically all of which remains unexplored. Eight sequences were defined between basement and the Cretaceous-Jurassic unconformity. The sequences included lacustrine deposits that generate good seals and source rocks (Solorzano et al., 2001). This graben was formed during the Jurassic rifting, produced by the separation of the North and South American plates. The work focused on the Pre-Cretaceous also allowed the delineation of Cretaceous-Neogene structures along the main faults that formed the shoulders and other related faults. In these prospective alignments already are important oilfields that need to be extended.

Most interpretations made in the area were concentrated in the producing Cretaceous and Tertiary formations; however, in Venezuela the Pre-Cretaceous sedimentary rocks have been poorly studied. New 2D3C and 3D seismic surveys have very good resolution. Stratigraphic seismic sequence analysis was used to define the Pre- Cretaceous sequences. Paleozoic sediments have not been drilled in the graben, but probably they are present considering that the Cambrian rocks are found outside the graben, deposited under tidal influence (Solorzano et al ., 2001). The Jurassic deposits have mostly a fluvial origin, with some indications of marine influence indicating that the Espino Graben was frequently connected to the open sea.

The study accurately determined structure of the graben interpreted as intense block faulting and inversion structures. The bounding faults of the graben have great extension and slip, however they are not continuous; this discontinuity is associated with important transfer zones that generate positive structures and depocenters with lacustrine deposits which favor the prospectivity of the area. The

graben has been reactivated on several occasions, producing three types of structures: rotated blocks, transfer zone and roll over, evidenced by the propagation of faults at different levels during the Cretaceous-Oligocene and Miocene.

The Espino Graben represents one of the most important exploration opportunities in the country and according to the economic evaluation, the expectations associated with the six structural traps are significant.

Selected References

Motiscka, P., 1985, Mesozoic volcanism in the basement of the Orinoco Oil Belt, the state of Guarico, Venezuela (*Vulcanismo Cenozoico en el subsuelo de la Faja Petrolífera del Orinoco, Estado Guarico, Venezuela*), *in* VI Congreso Geológico Venezolano Boletín de Geología, Publicación Especial, Ministerio de Minas de Energía y Minas, v. 6, p. 1929–1943.

Solorzano E., I. Paredes, M. González., O. Gallango, and B. Aguado, 2001, Sedimentological data, geochemical and biostratigraphic hole in the NZZ-88X-14 712 interval 6559', *in* Studies of possible bedrock and pre-Cretaceous deposits, project 4020, (*Datos Sedimentológicos, Geoquímicos y Bioestratigráficos del pozo NZZ-88X en el interval 6559´-14712: Estudios de possible roca madre y yacimientos pre-cretácicos, proyecto 4020*), International Conference *Petroleos de Venezuela*, S.A. (PDVSA-INTEVEP S.A., INT-8767, 2001).

NEW EXPLORATION TRAPS IN THE ESPINO GRABEN. EASTERN VENEZUELA BASIN.

Yoasmali Barrios [1], barriosyf@pdvsa.com, Noelia Baptista [1] and Grover Gonzales [2].
(1) Petróleos de Venezuela, PDVSA Exploration Management. (2) EXGEO-CGG Veritas.

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OUTLINE

- INTRODUCTION
- AVAILABLE DATA
- GEOLOGICAL SETTING
- STRATIGRAPHIC MODEL
- SEISMIC INTERPRETATION
- EXPLORATION OPPORTUNITIES
- CONCLUSIONS

THE MAIN GOAL

SEARCHING FOR NEW STRUCTURAL TRAPS IN ESPINO GRABEN, BELOW THE TRADITIONAL ORINOCO HEAVY OIL BELT (THE BIGGEST OIL RESERVES IN THE WORLD)

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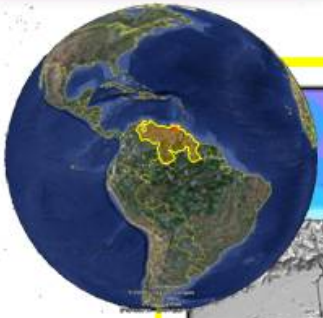
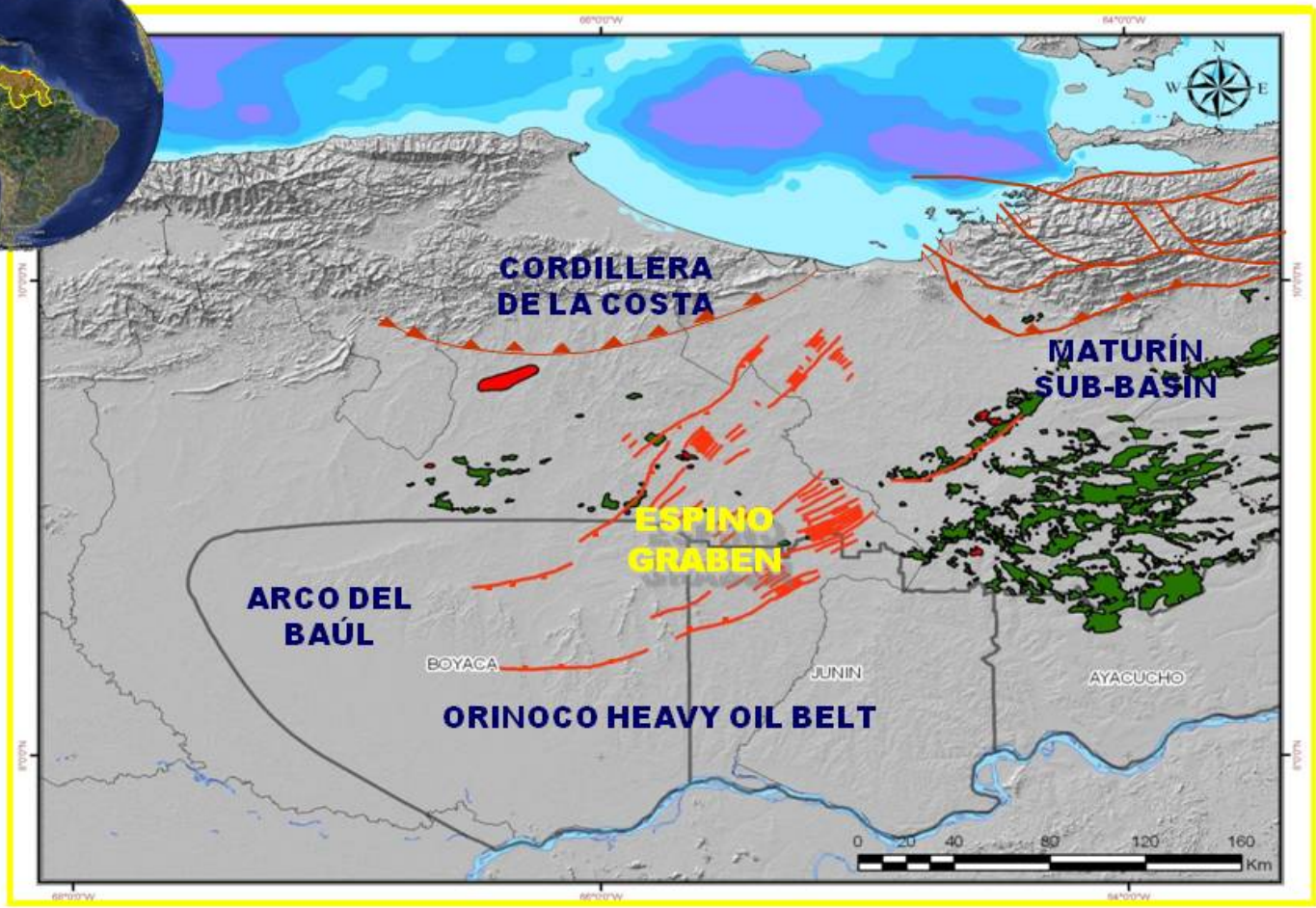
STUDY AREA

Eastern Venezuela Basin





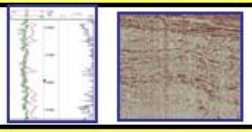
METHODOLOGY

DATA SOURCE

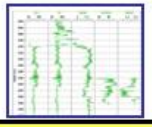
PREVIOUS STUDIES

- Uzcátegui D, 2002
- Ríos K, 2002
- Marquez E, 2003
- Salazar M, 2006
- Chaplet M, 2007
- Duerto L, 2008

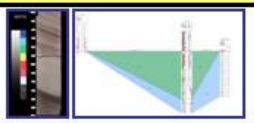
2D AND 3D SEISMIC AND WELL LOGS



VELOCITY DATA: CHECK SHOT, SONIC AND DENSITY



STRATIGRAPHY



PROCESSES

1. WELL TO SEISMIC CALIBRATION
2. SEISMIC INTERPRETATION
3. INTEGRATION OF STRATIGRAPHIC INFORMATION
4. MAPPING (Structural and Isopach)

RESULTS

STRUCTURAL TRAP IDENTIFICATION

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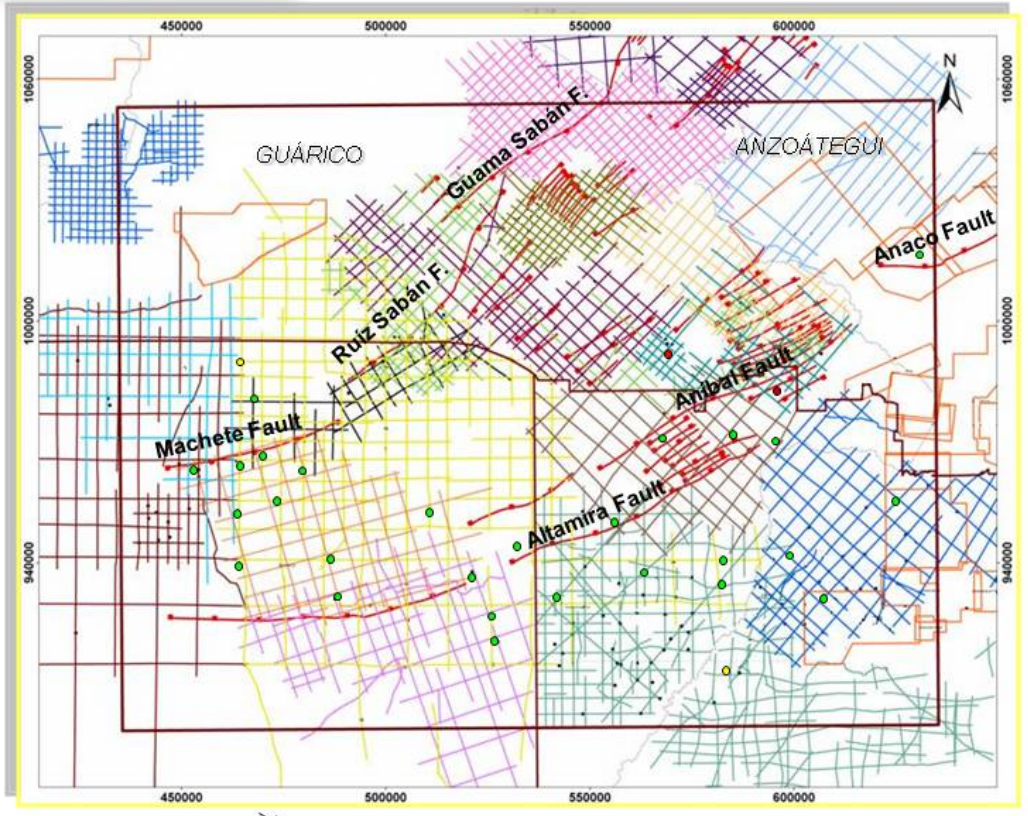
AVAILABLE DATA



STUDY AREA:
40,000 Km2

SEISMIC:
2D: 15,000 Km
3D: 1,730 Km2

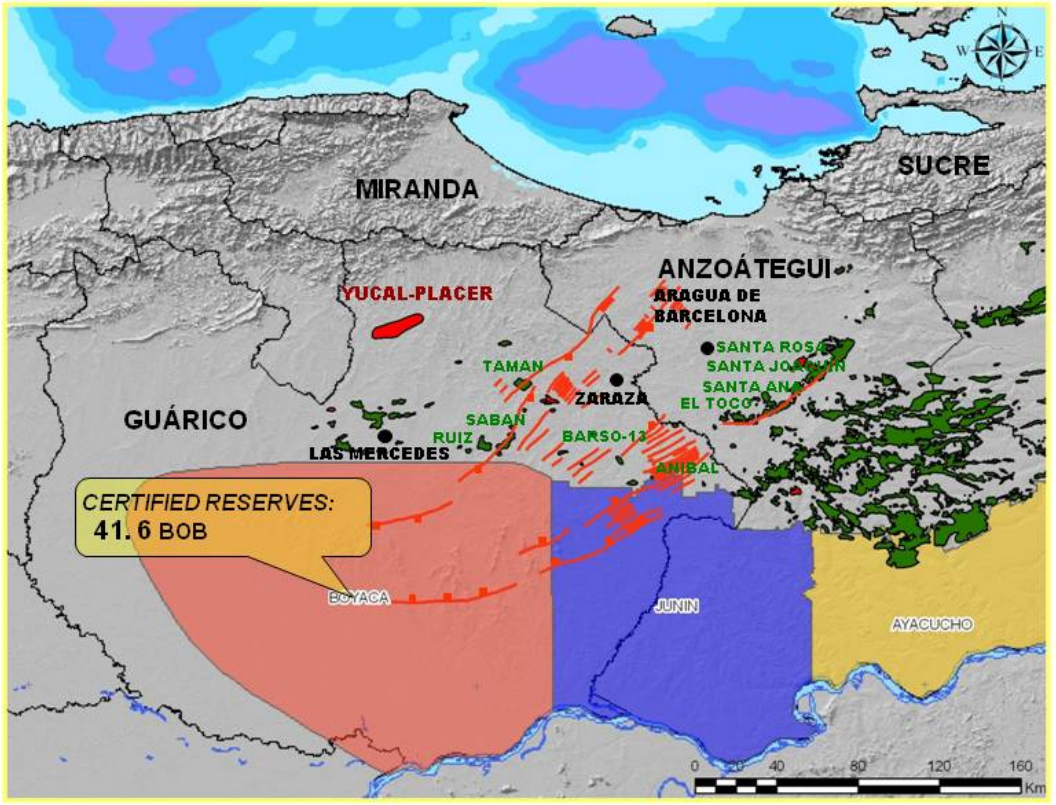
WELLS: 28

VELOCITY CONTROL DATA:
CHECK-SHOT, DENSITY AND SONIC LOGS

- HIGH QUALITY (3 Logs)
- MEDIUM QUALITY (2 Logs)
- LOW QUALITY(1 Log)

Faults | 2D Seismic | 3D Seismic | Well

AVAILABLE DATA



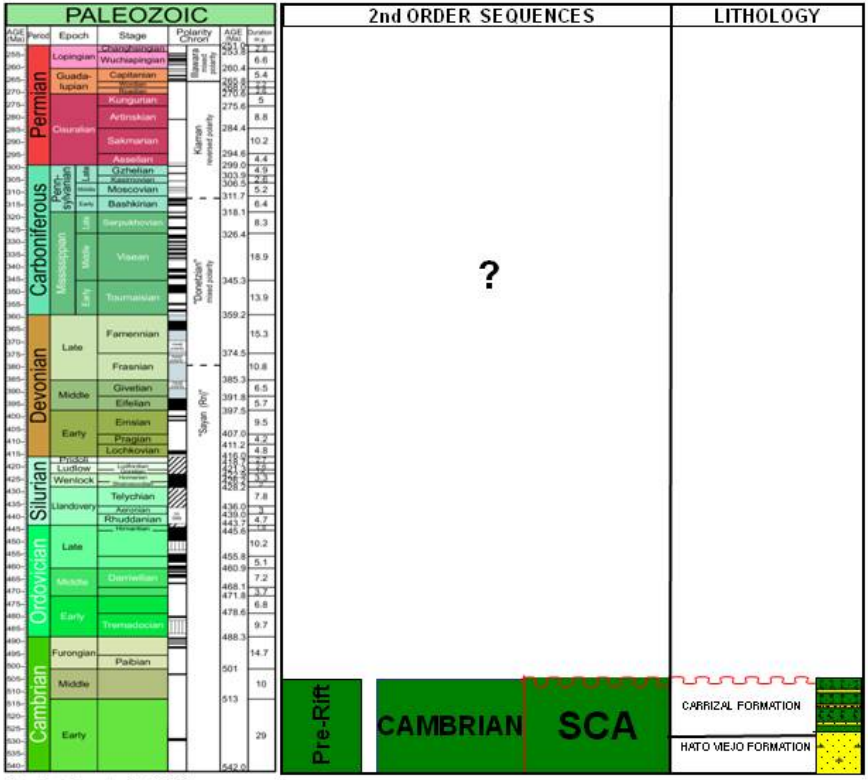
Oil field

Gas field

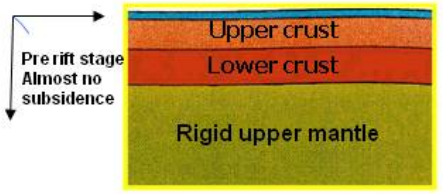
City

Mesozoic and Paleozoic sedimentary thickness exceeds 20,000 feet (unexplored)

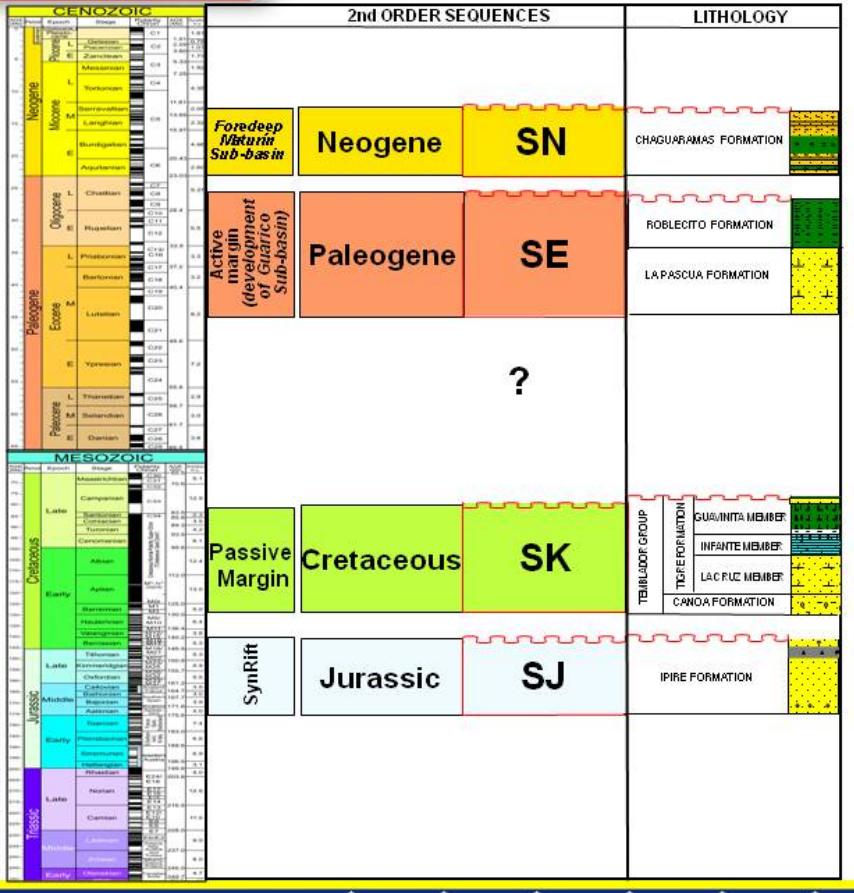
GEOLOGICAL SETTING

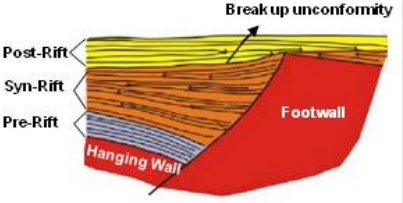


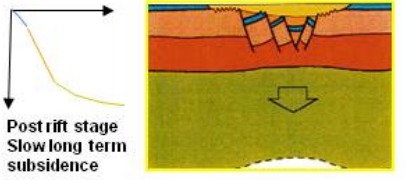
Gradstein et al., 2004

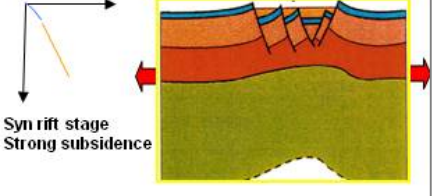


GEOLOGICAL SETTING
RIFT STAGE





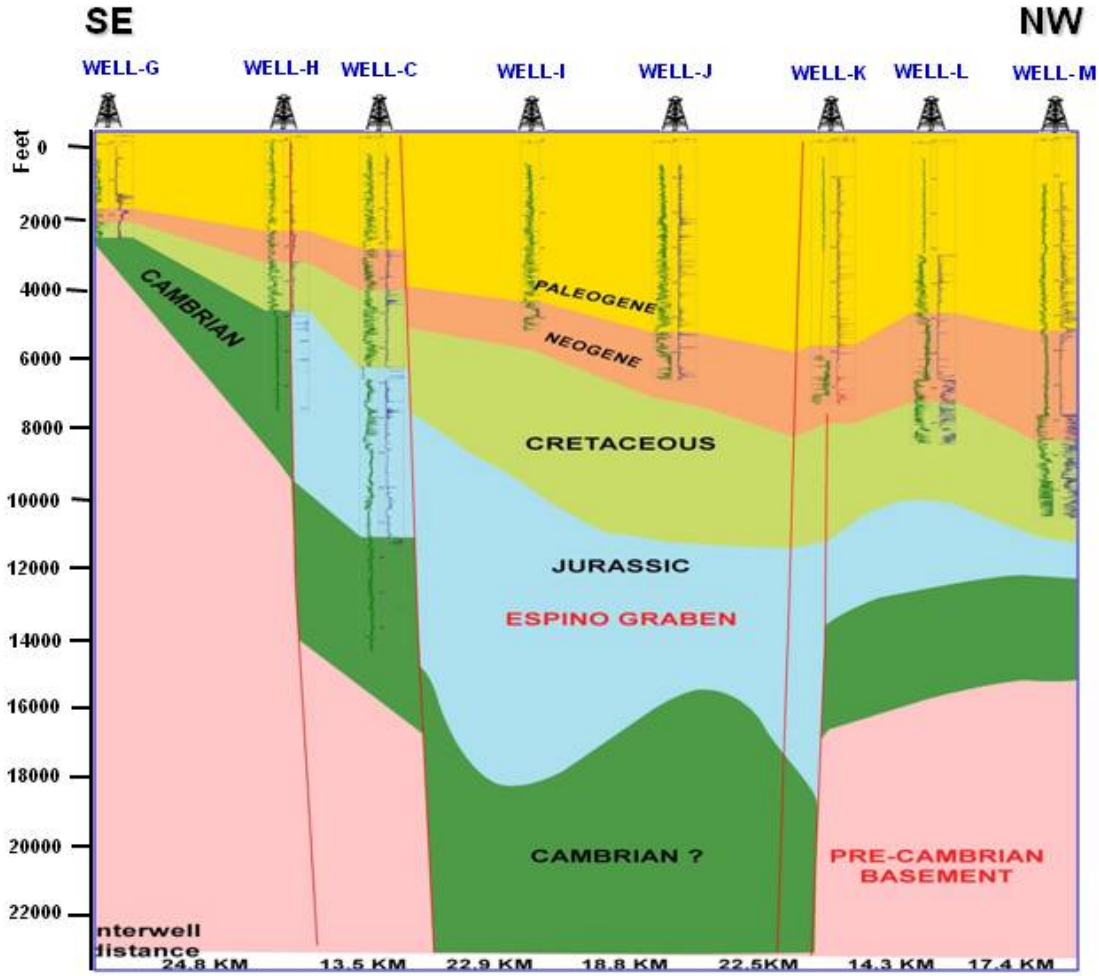


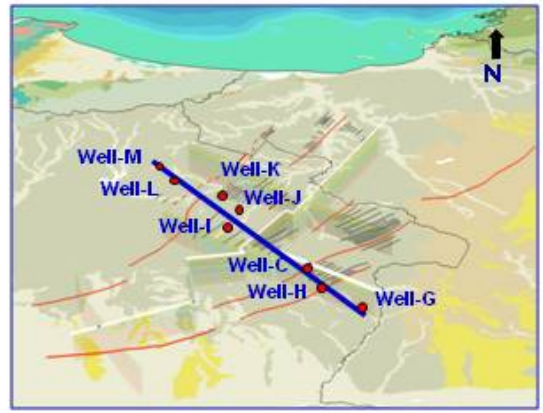


Gradstein et al., 2004

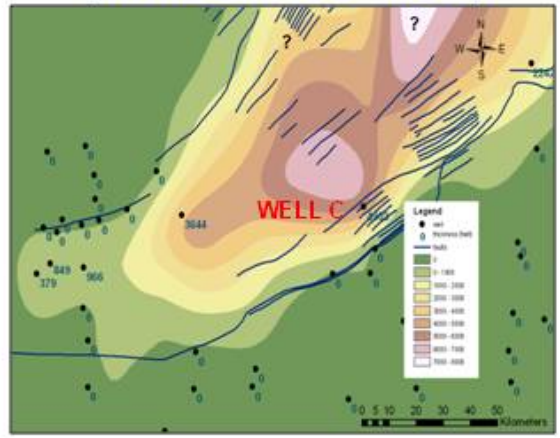
STRATIGRAPHY

SCHEMATIC CROSS SECTION

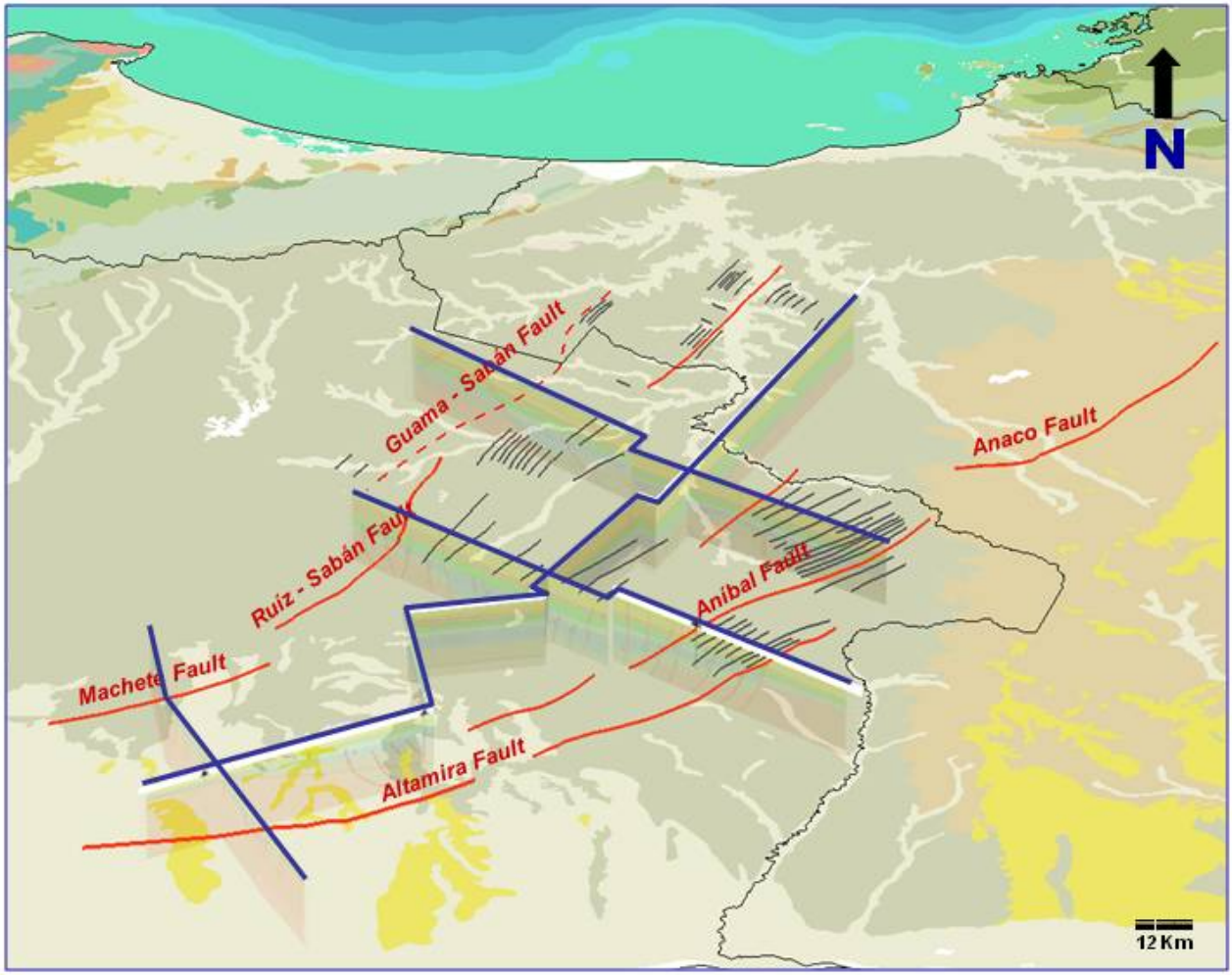




TOTAL THICKNESS MAP (JURASSIC SECTION)



SEISMIC PROFILES



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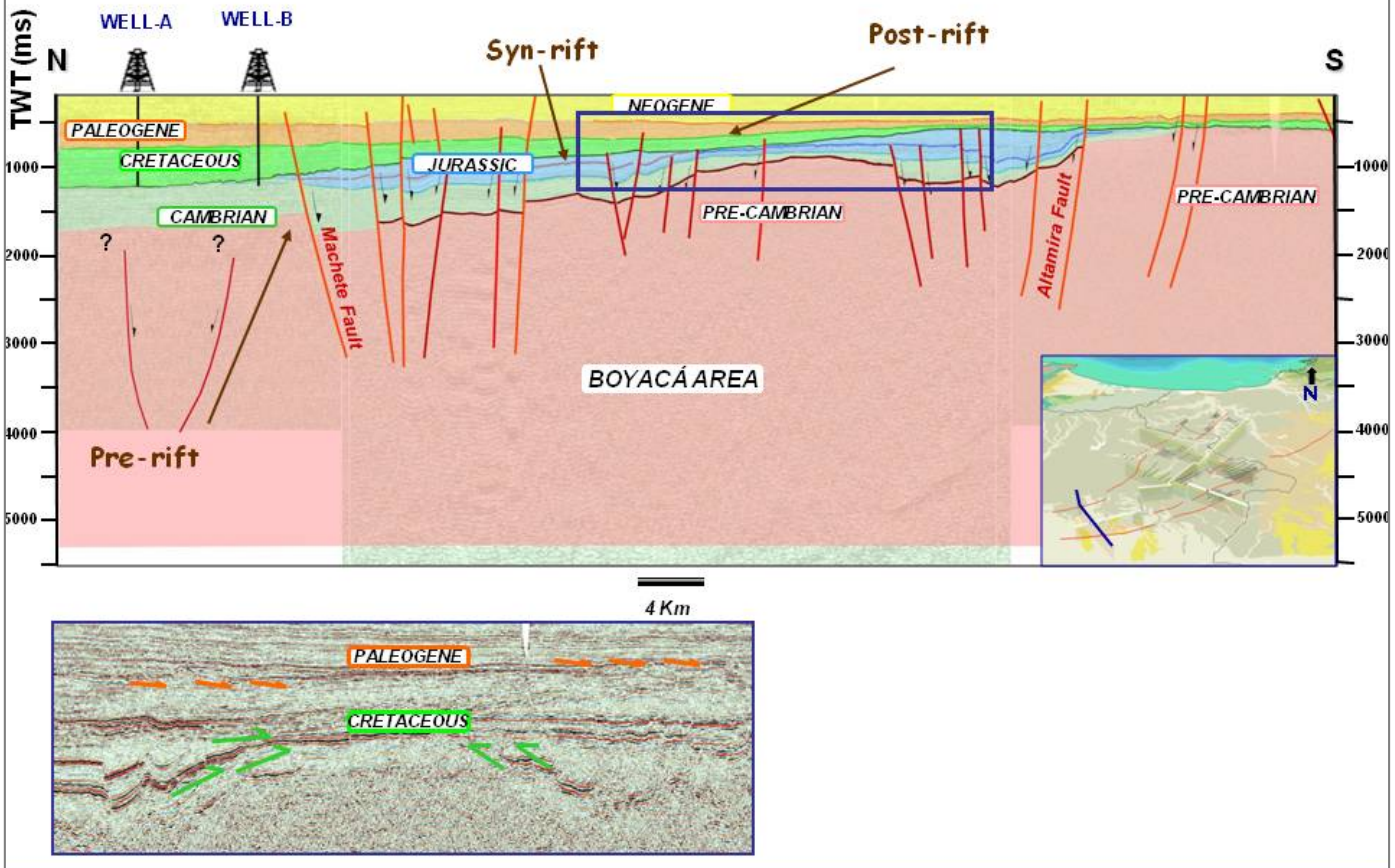
SEISMIC INTERPRETATION



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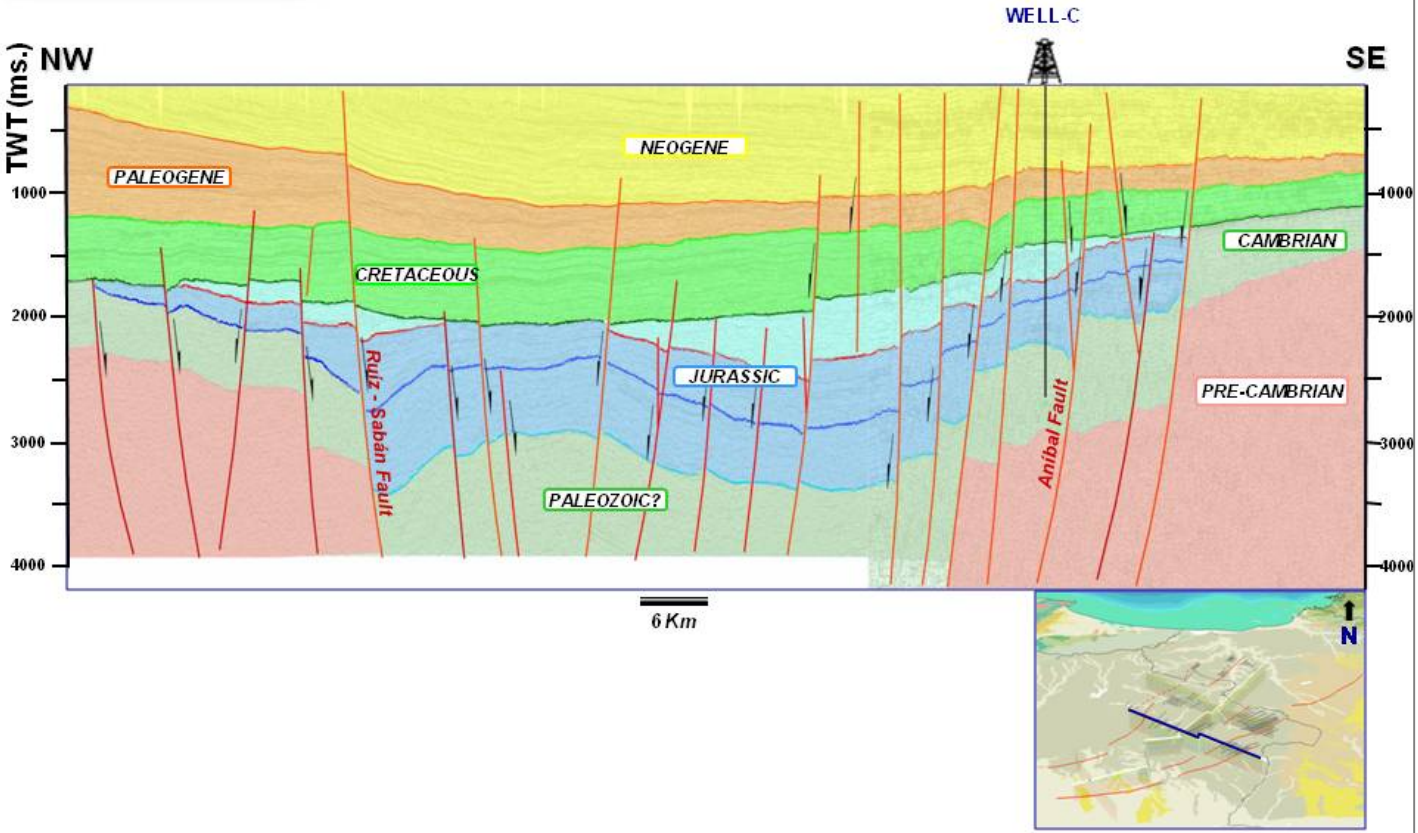

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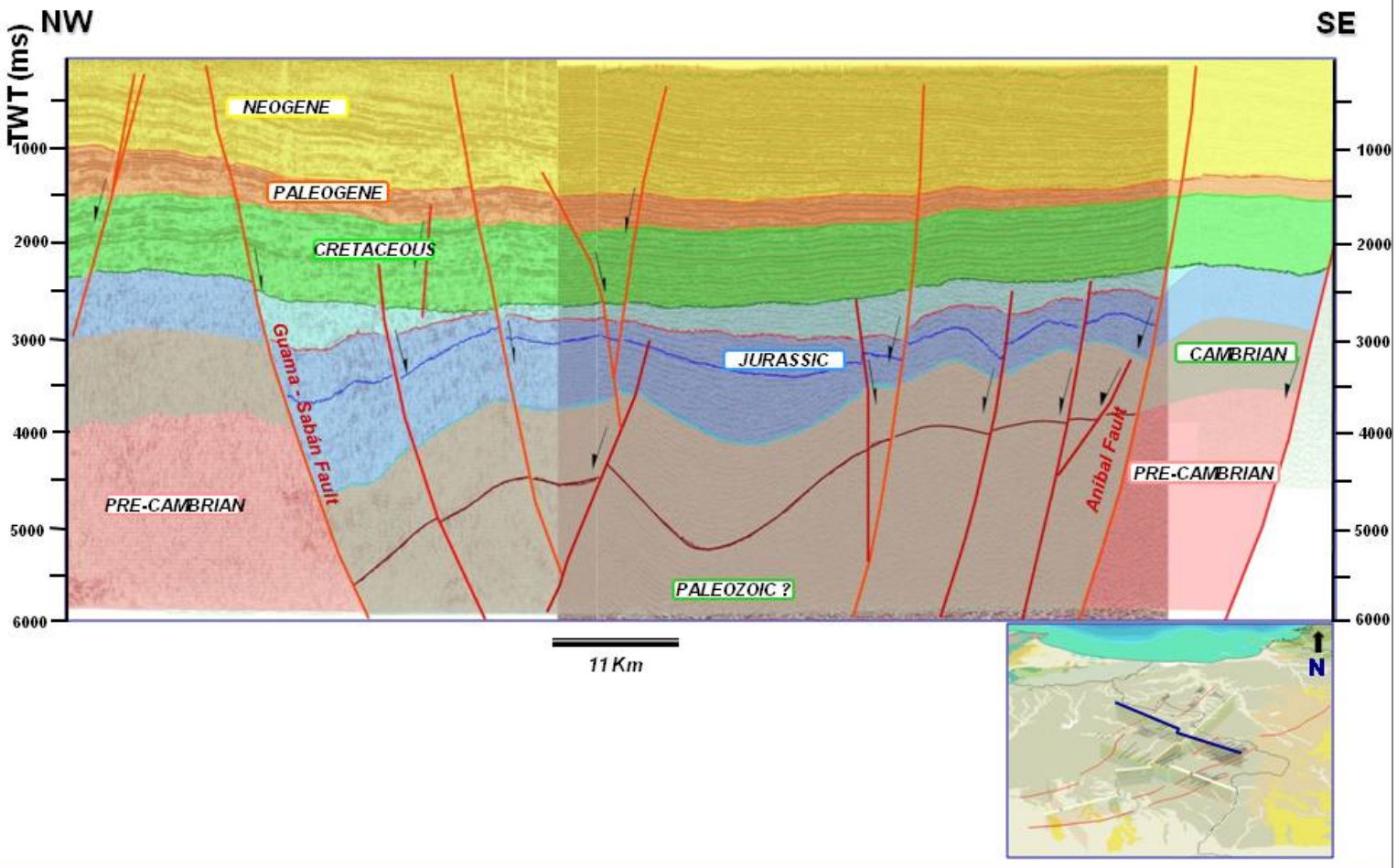

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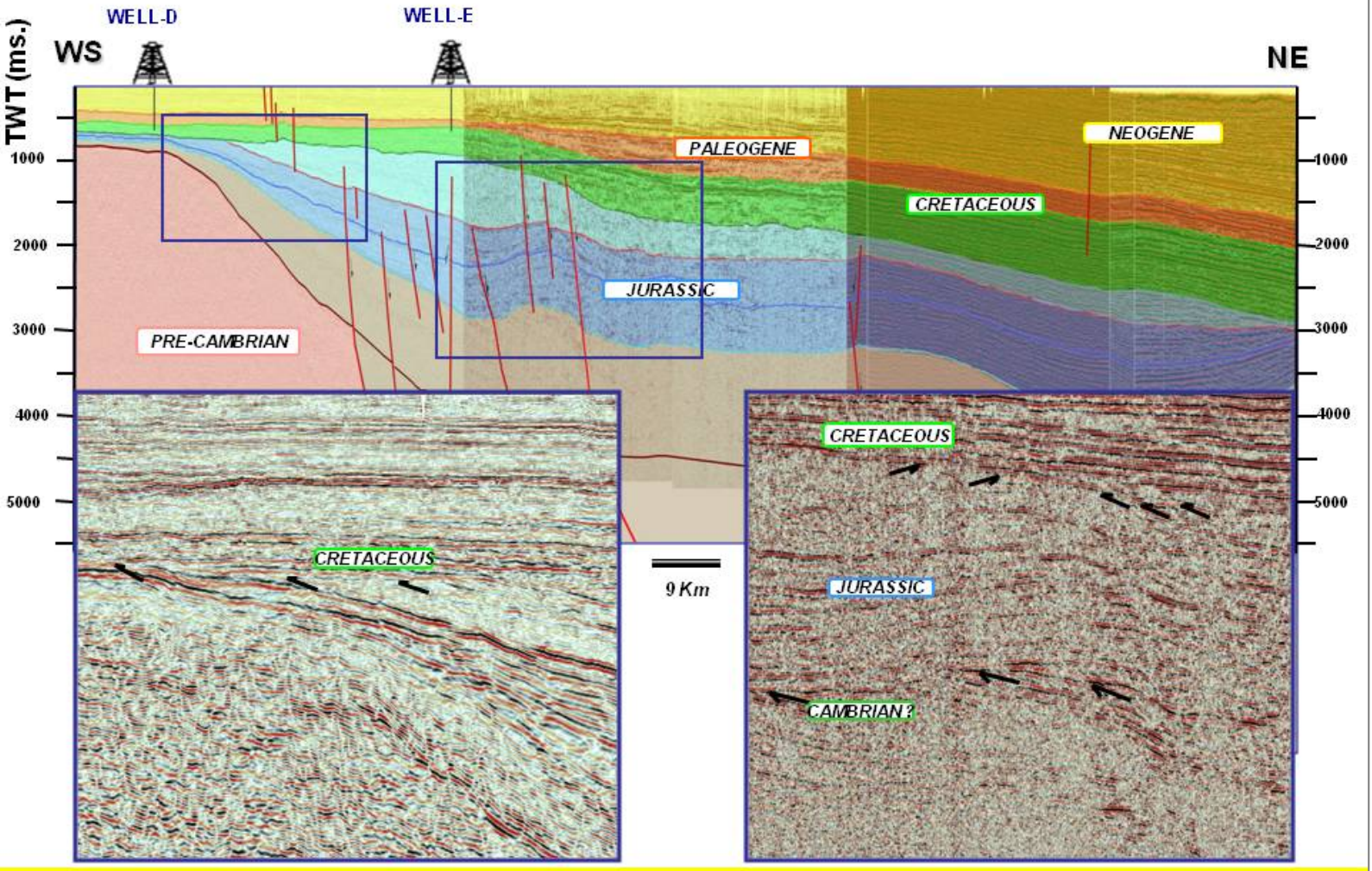
SEISMIC INTERPRETATION



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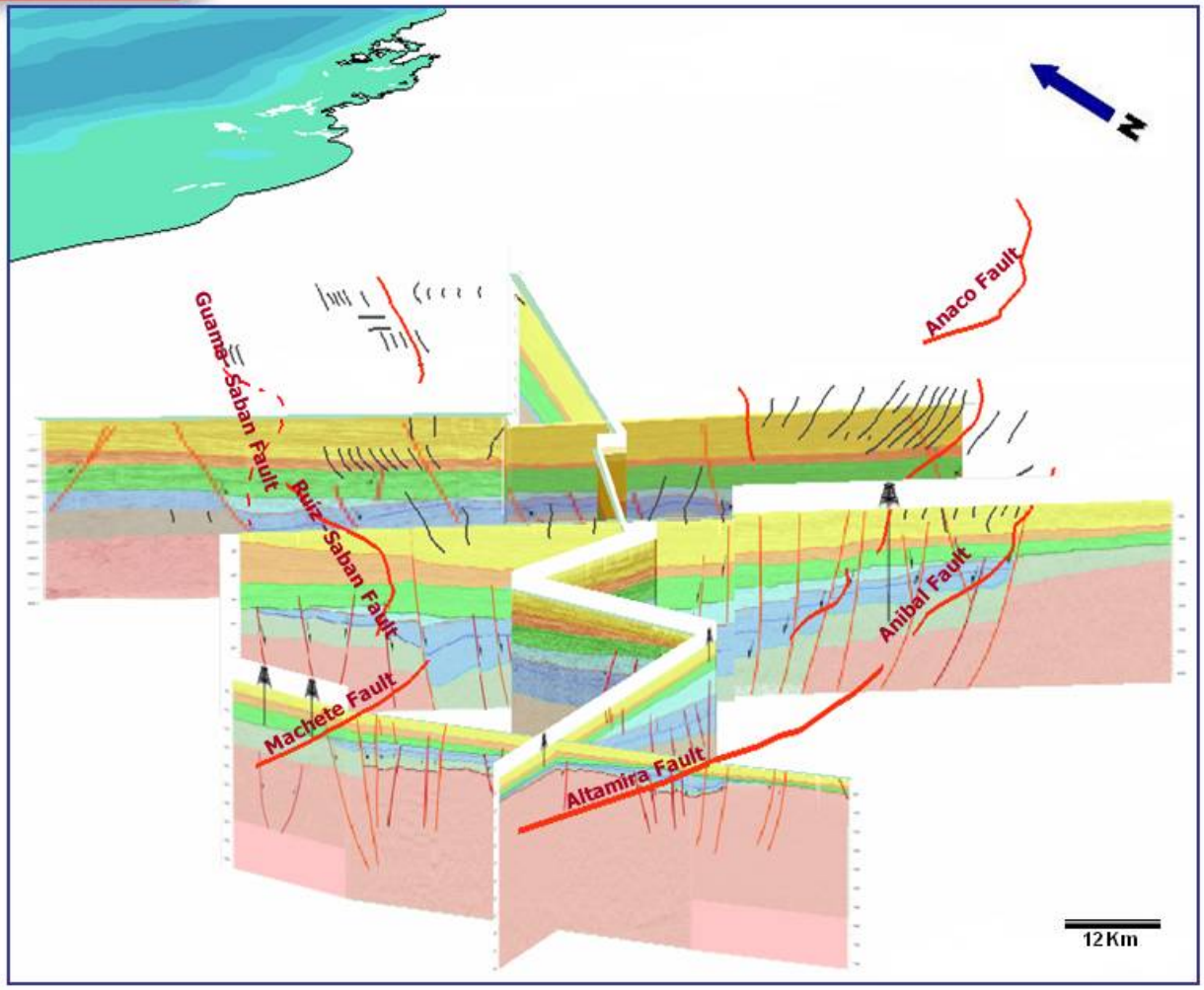

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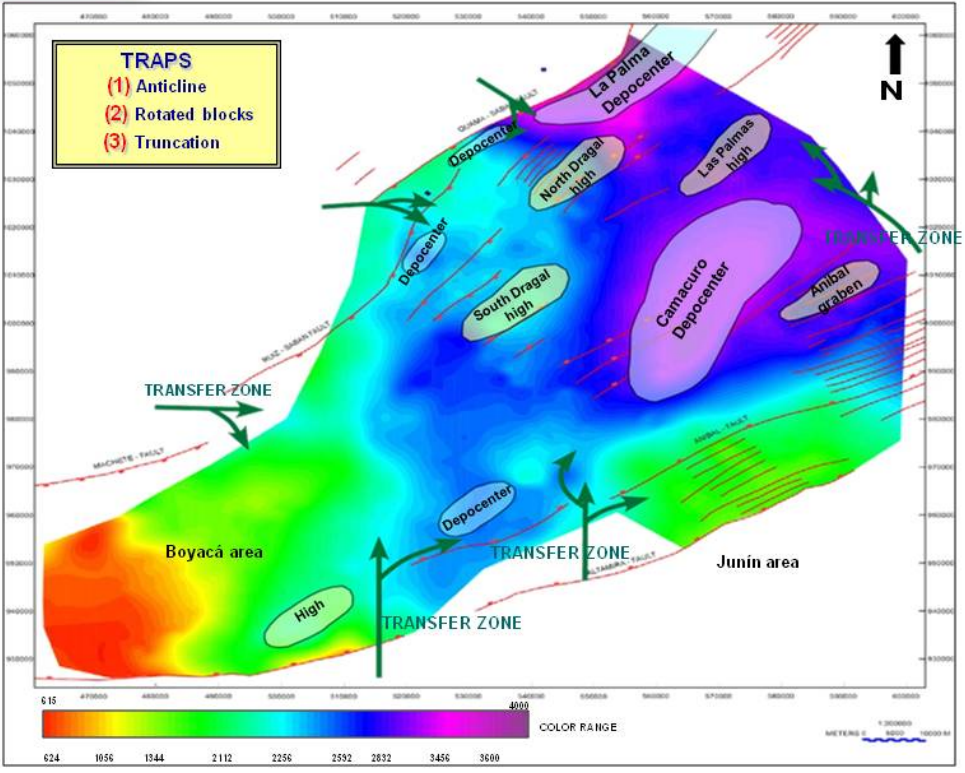

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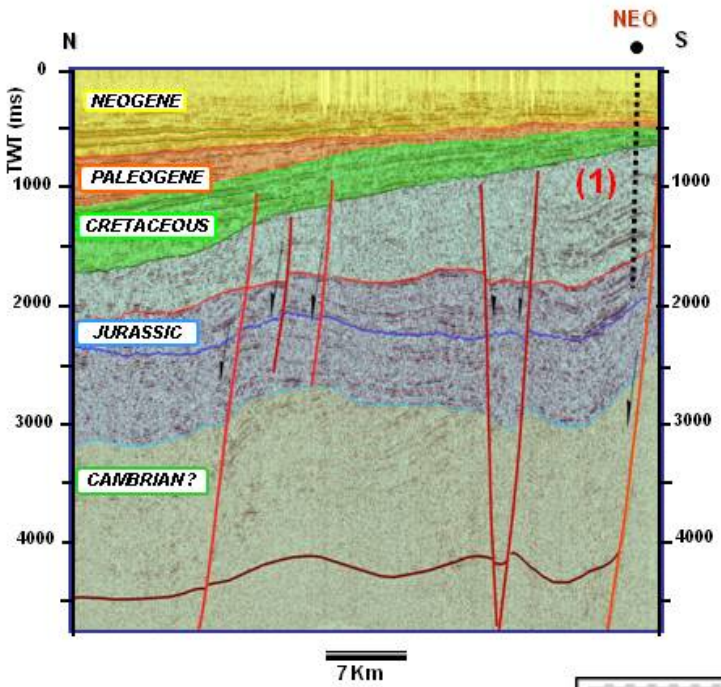
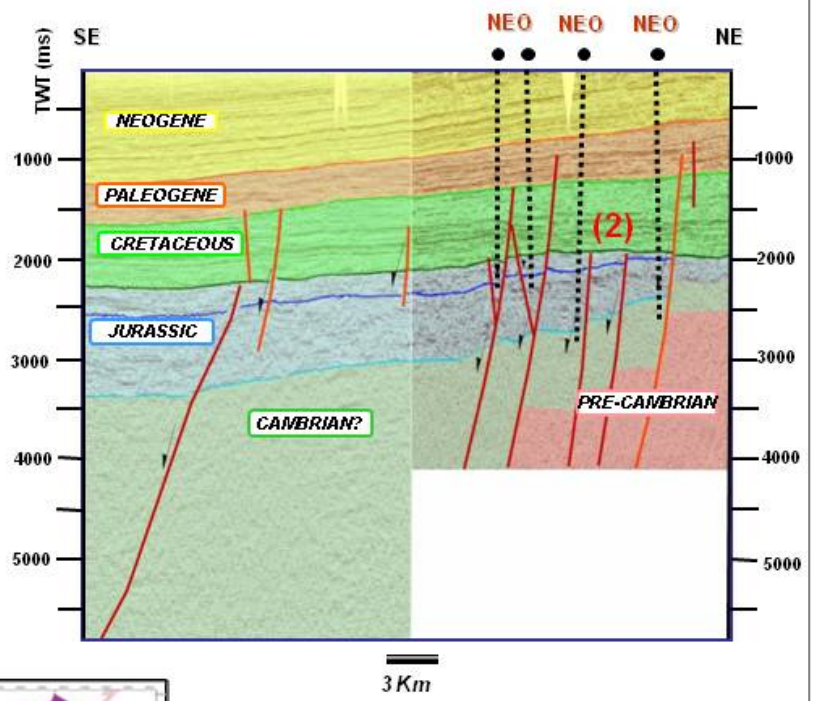
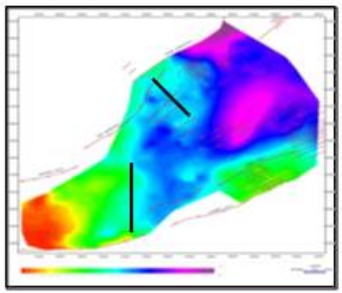
TRAPS TYPE





TRAPS
(1) Anticline
(2) Rotated blocks



* New Exploratory Opportunities
= NEO

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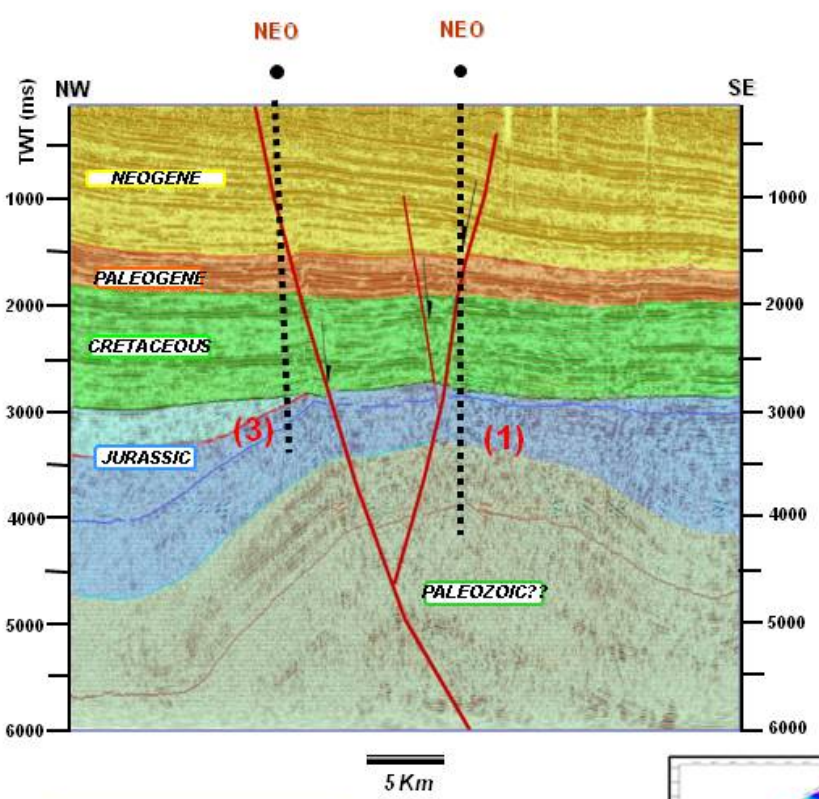
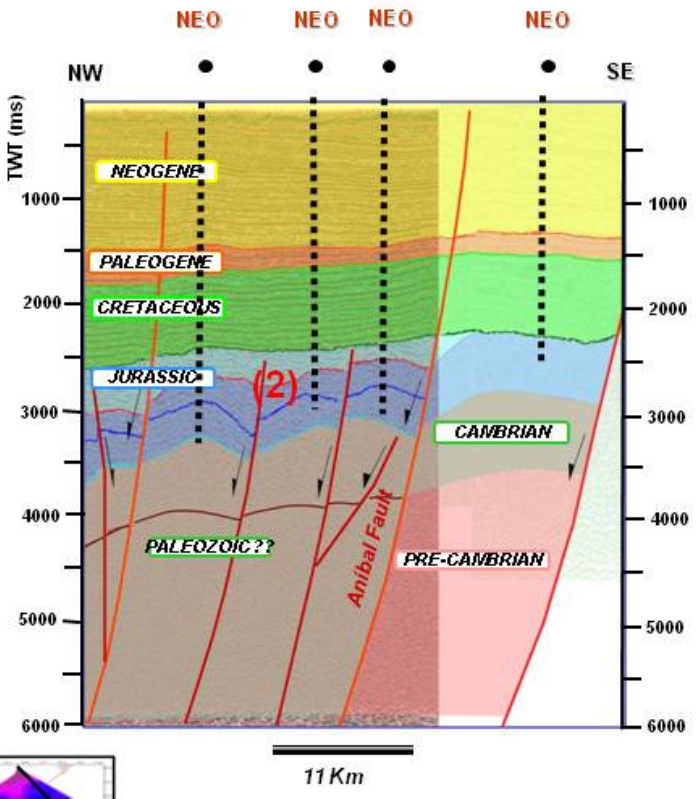
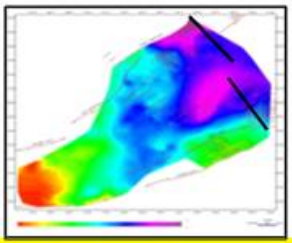
TRAPS TYPE





TRAPS
(1) Anticline
(2) Rotated blocks
(3) Truncation



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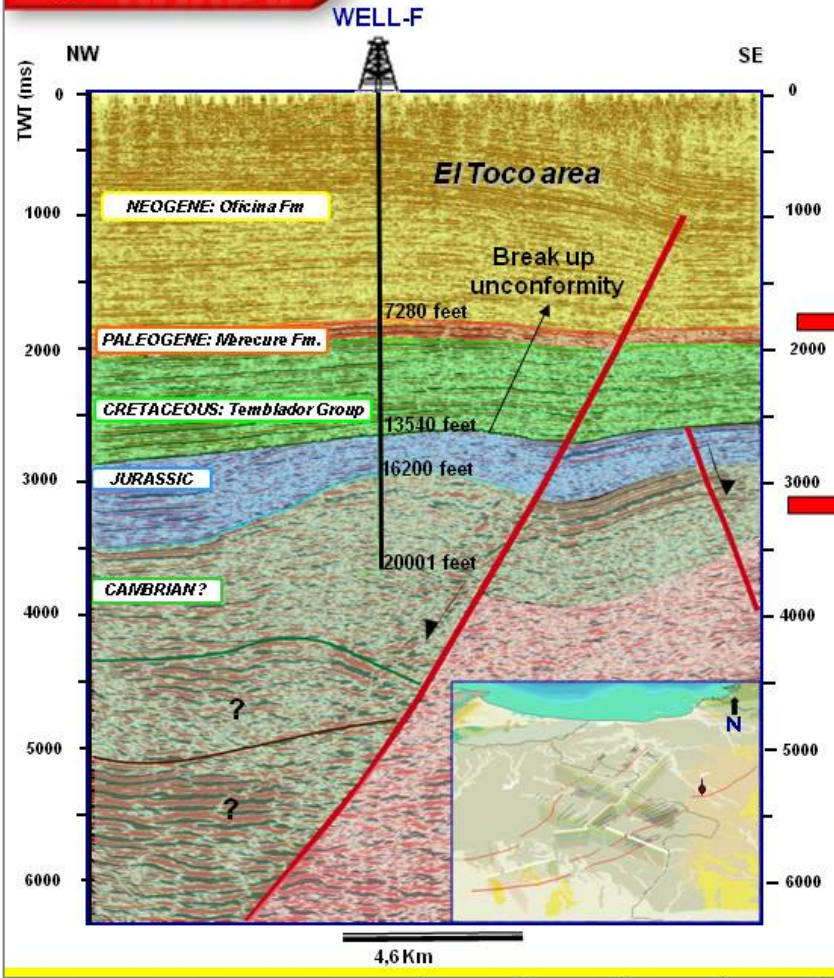
STUDY CASE



- Paleogene: Fluvial Deltaic Environment
- Production (Merecure Fm- Paleogene):
  3,865.9 BPD
  11.8 MMcf/d
- Porosity: > 10%

- Jurassic and Paleozoic: Braided Delta enviroment.
- 18167 - 20001 feet showed gas including C5, but it was not proven by mechanical problems.

The result of this study will be consider for further exploration!!!

CONCLUSIONS

- Using sequence seismic stratigraphic analysis prospective structures in the Espino Graben that present intense block faulting and inversion zones were determined.
- The graben was reactivated in several periods producing different types of traps like: anticlines, rotated blocks and truncations.
- The graben structure has influence in Neogene and Paleogene formations related to important hydrocarbon fields.
- Transfer zones generate positive structures and depocenters with possible lacustrine deposits that favor the prospectivity of the area.