# The Intramalmic-Intersenonian Interval in the NE Border of the Neuquén Basin. Remaining Prospectivity Assessed Through Paleoenvironmental Models and Sequential Analysis*

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## Abstract

Proper sequential analysis is essential for the exploration and development of oil and gas fields, especially in conventional plays in highly mature basins such as it is the Neuquén Basin in western Argentina. Reassessed paleoenvironmental models and sequence stratigraphic framework constitute key elements to define remnant oil and gas fields' prospectivity for the Intra-Malmic to Inter-Senonian stratigraphic interval in the Northeastern Platform of the Neuquén Basin. A methodology that extended through a broad scale of analyses, going from regional seismic interpretation, well log interpretation, to detailed characterization of core and cuttings, was used to define depositional trends and significant stratigraphic surfaces, and to develop paleo-environmental evolution models of the Loma Montosa and Centenario Formations. Limited at its base by a transgressive surface and at its top by the Intra-Valanginian unconformity, the Loma Montosa Formation is interpreted to represent a mixed carbonate-siliciclastic ramp, with marginal-marine siliciclastic and mixed inner-ramp carbonate grainstones as the main reservoir facies. Several progradational sequences limited by transgressive and/or regressive surfaces are recognized within the unit. The Centenario Formation is limited at its base by a transgressive surface and in its top by the Inter-Senonian unconformity. In the study area, it comprises at least two transgressive-regressive sequences, defined as Lower and Upper Centenario Members. This mixed sandstone-shale succession is interpreted as a marginal marine and fluvial environment where tide- and wave-dominated deltas can be recognized. Stratigraphic traps associated with erosional truncation and lateral facies change constitute the main trapping mechanisms for the large oil fields present in the Rio Colorado Productive Trend.


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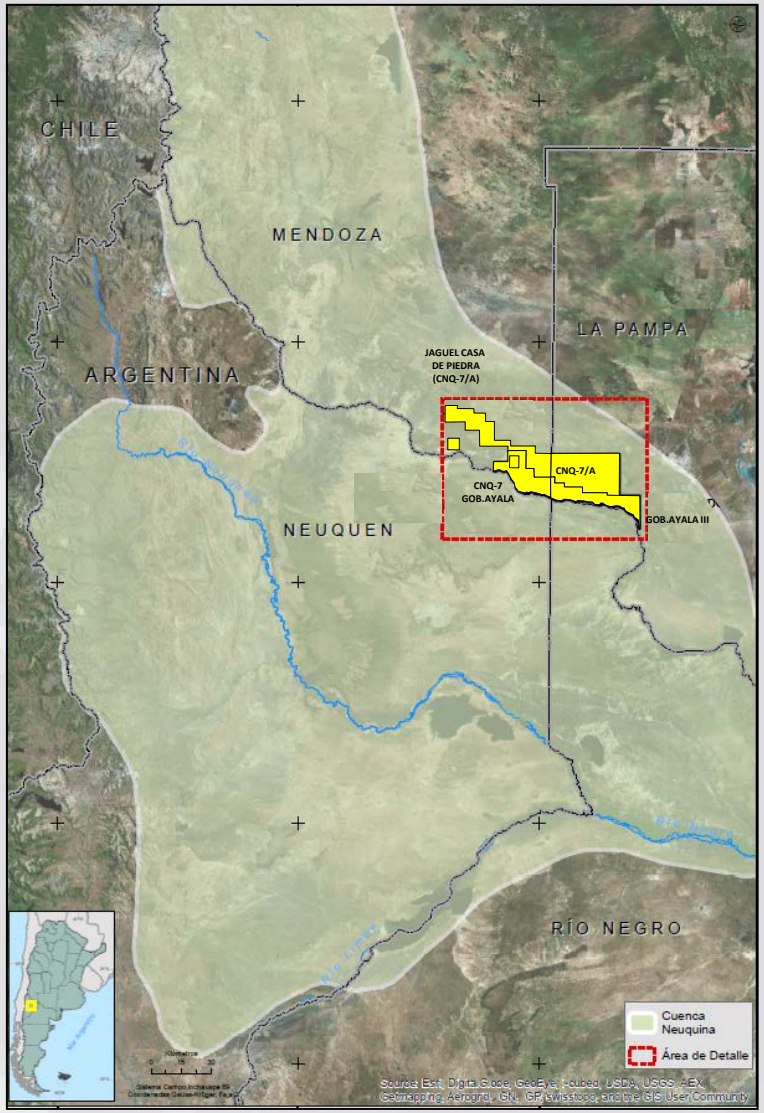
# INTRODUCTION & MOTIVATION

- Studied zone is located in the NE of the Neuquina Basin Platform

- RCPT is one of the largest hydrocarbon conventional discoveries of the last 15 years in Argentina

- High exploration maturity exists in the zone associated to the existence of 62 exploration wells

- Remnant hydrocarbon potential was assessed through a regional stratigraphic analyses and a paleoenvironmental characterization



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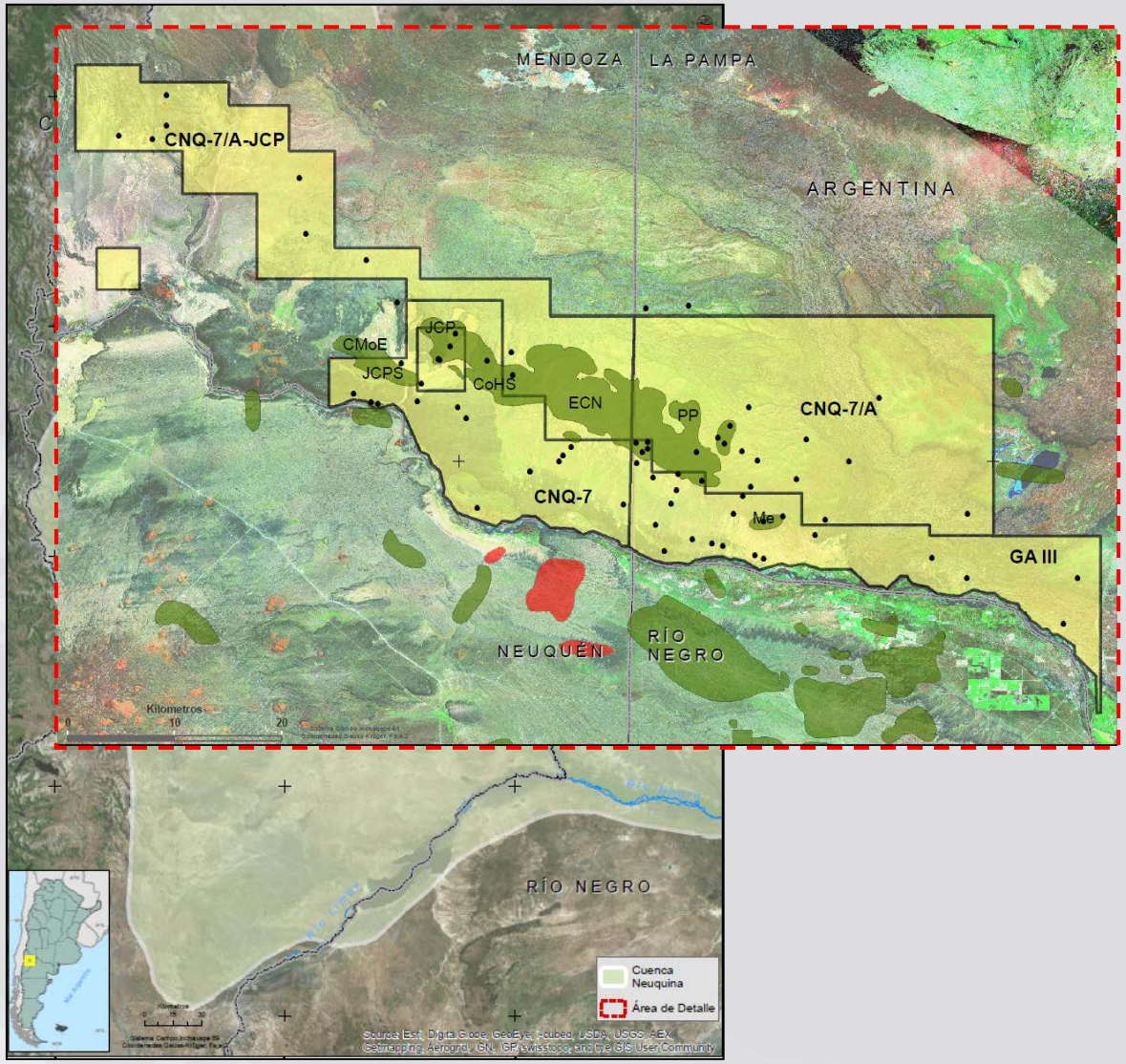
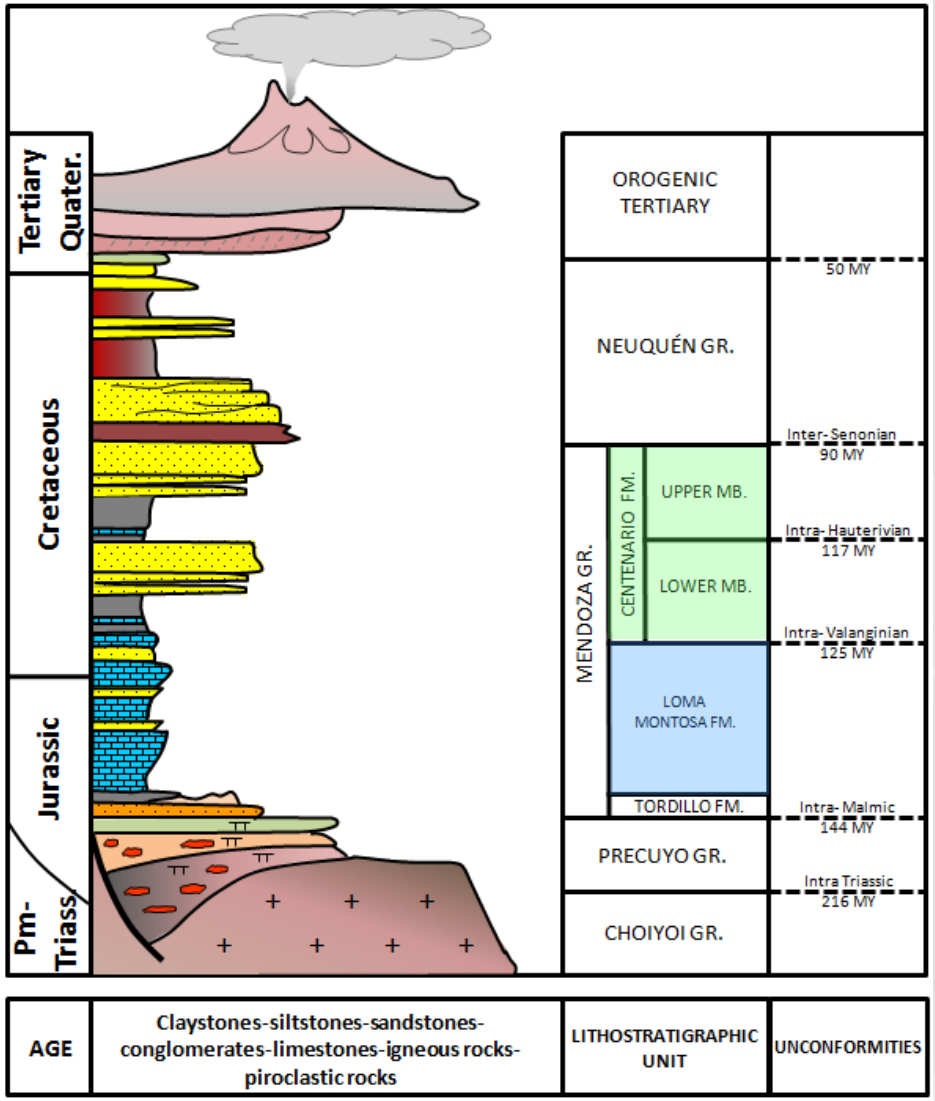
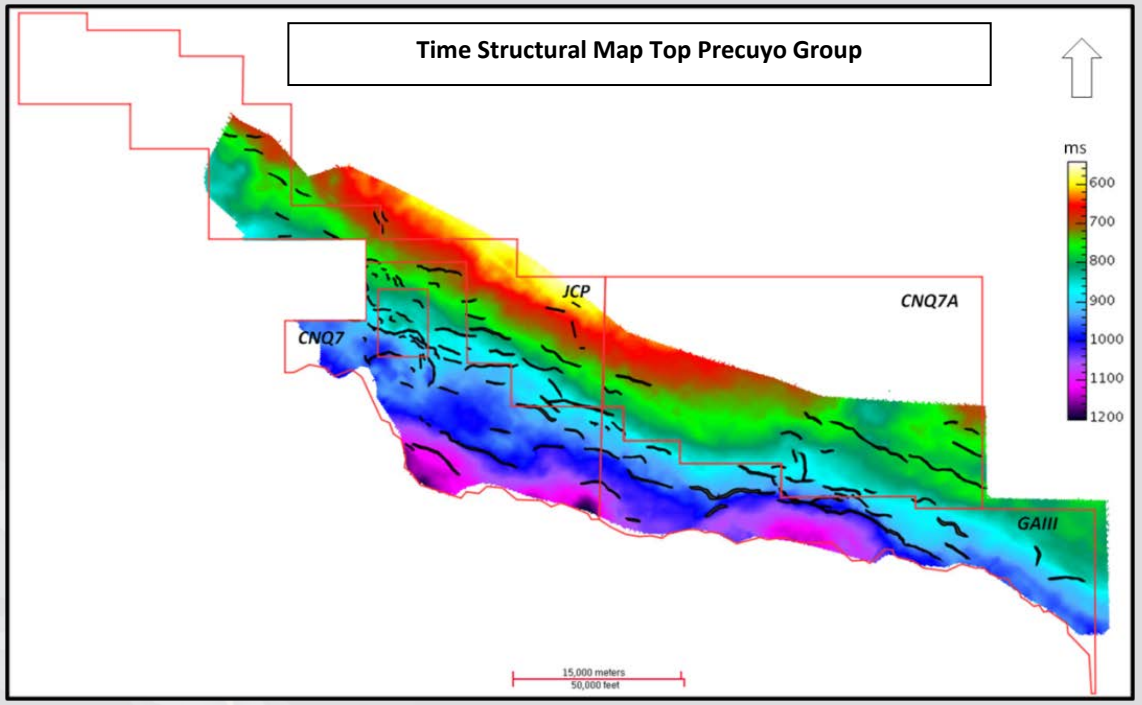


# GEOLOGIC FRAMEWORK



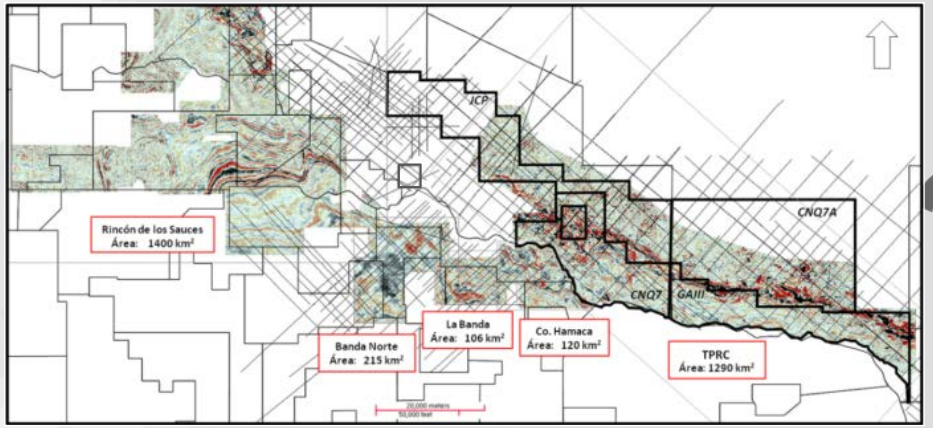

Modified from Brisson, 1996

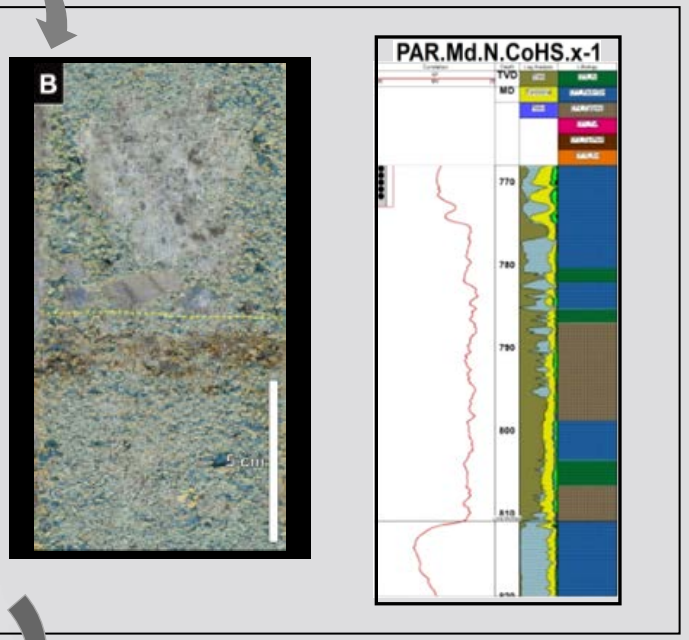


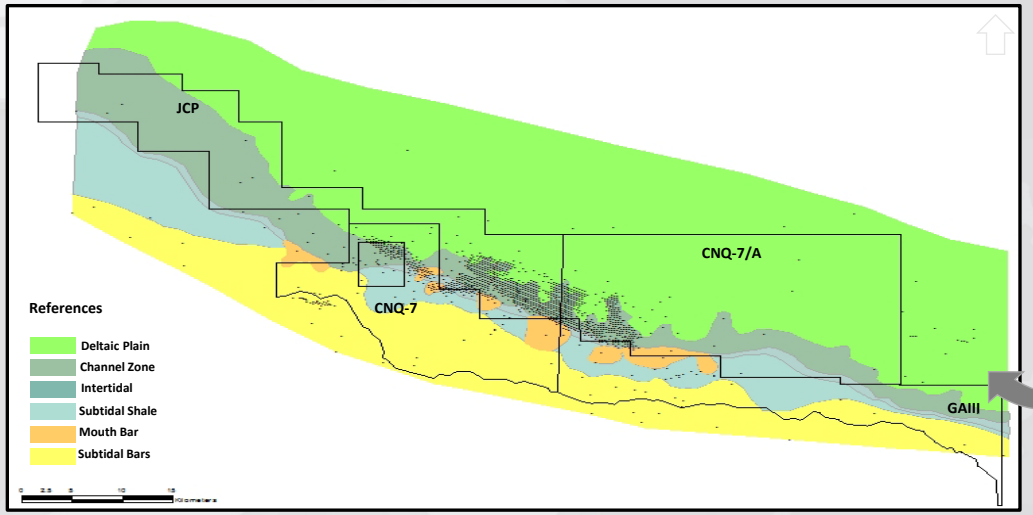

- The stratigraphic succession presents a limited thickness associated to erosion or no deposition
- Structural configuration is fairly simple given by a homocline

# OBJECTIVES & METHODOLOGY

- Identify stratigraphic units and their time span for the studied interval
- Build a sequence interpretation and a paleoenvironmental characterization
- Define plays and their remaining hydrocarbons potential



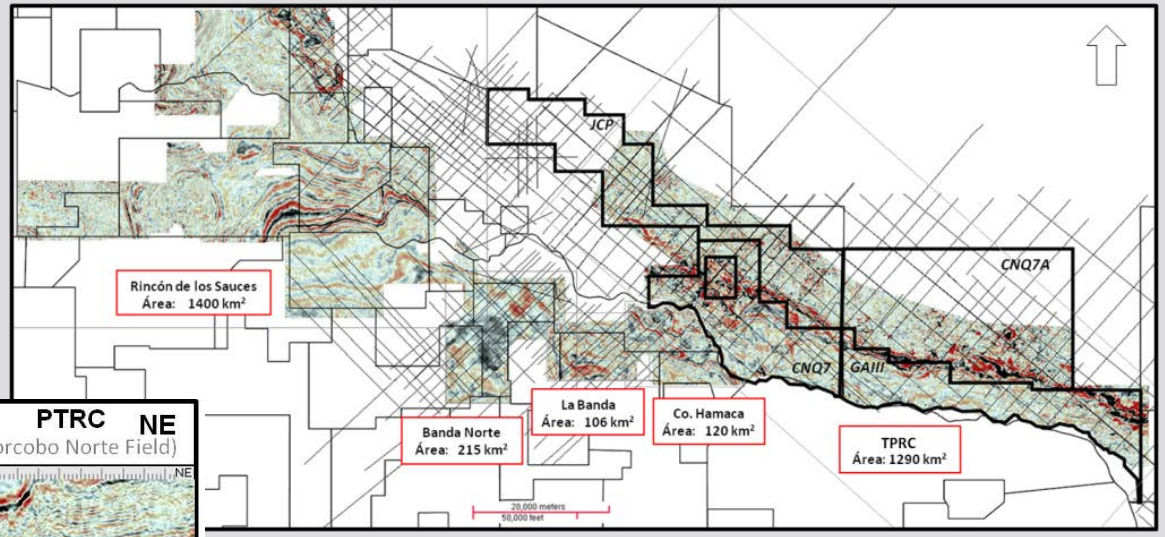



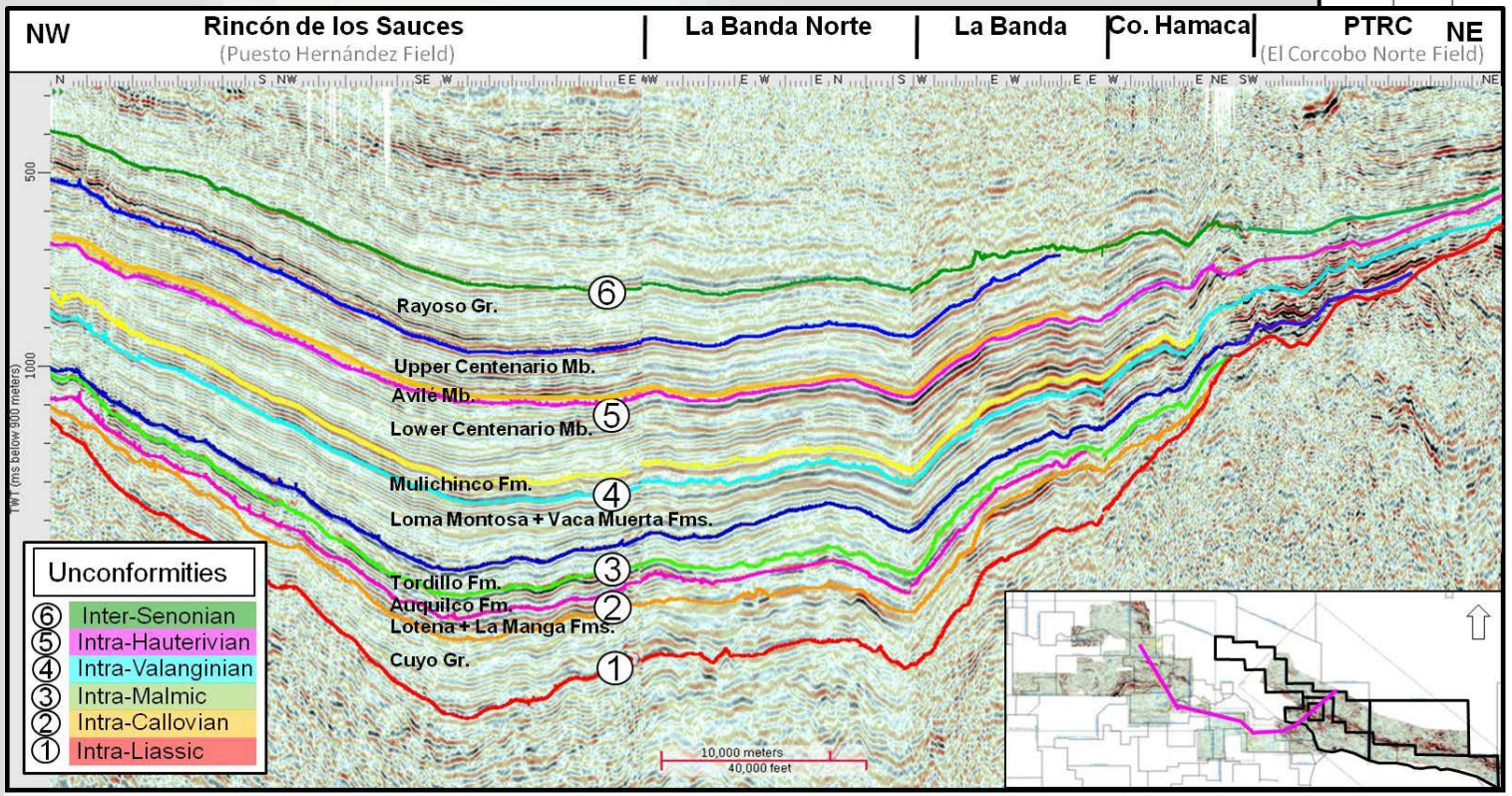

Macroscale

# MACROSCALE METHODOLOGY

- Integration of regional seismic interpreted and calibrated with well data

- Acquisition and interpretation of public data and seismic within the PTRC

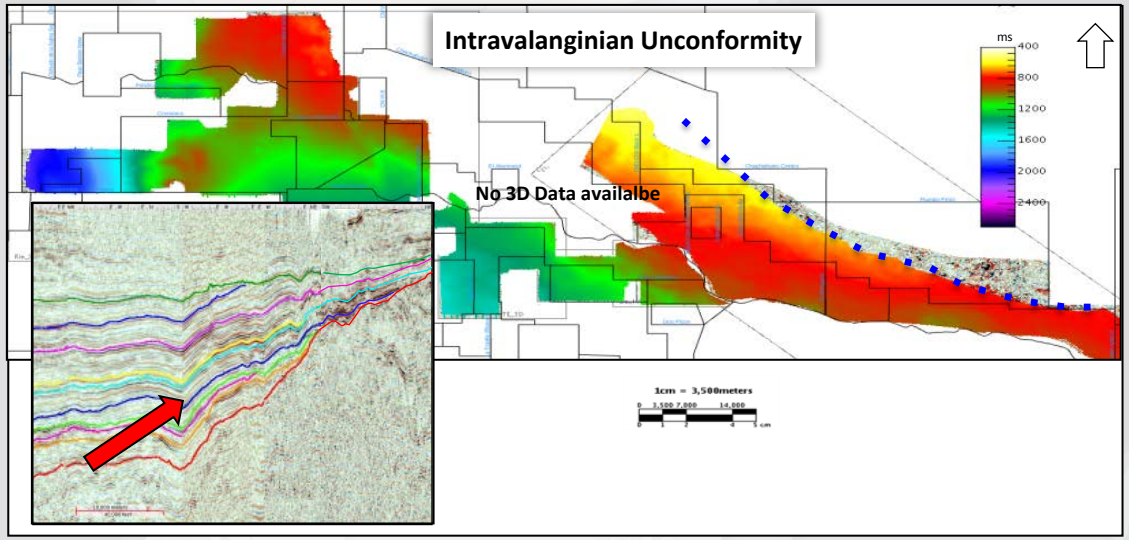


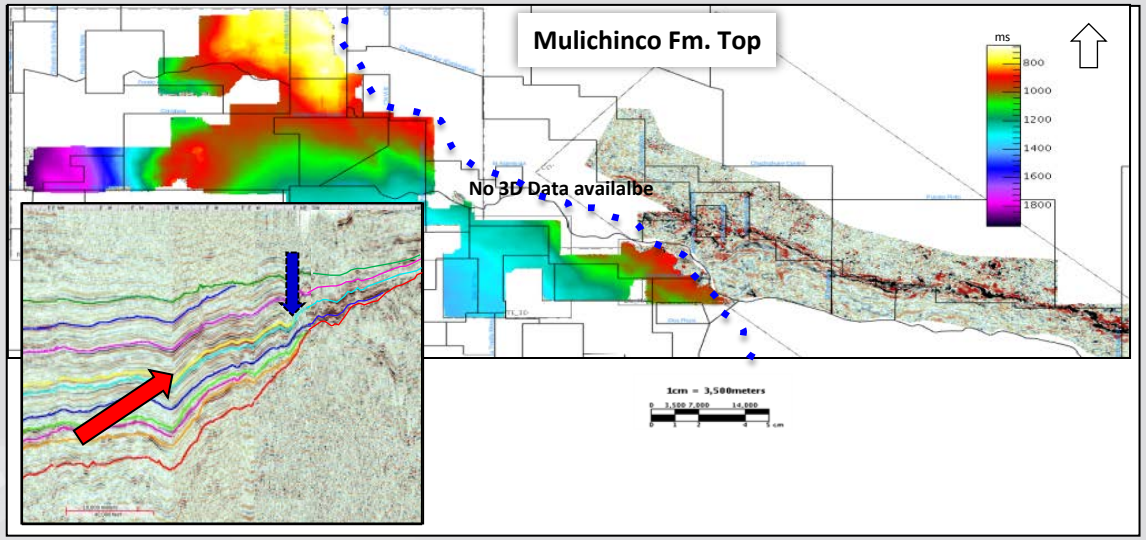



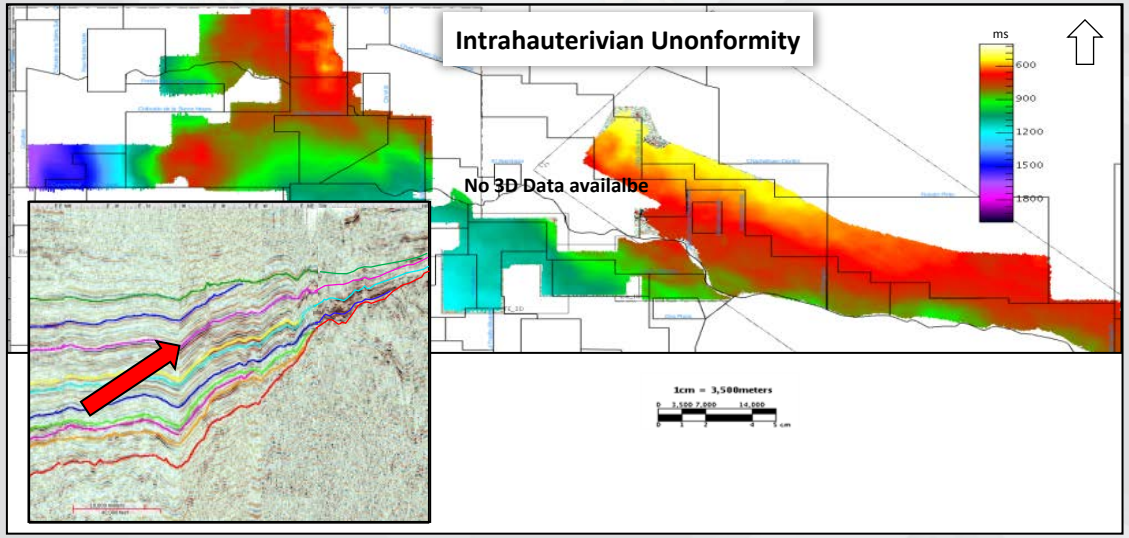

- Shallowing of the interpreted units toward the NE

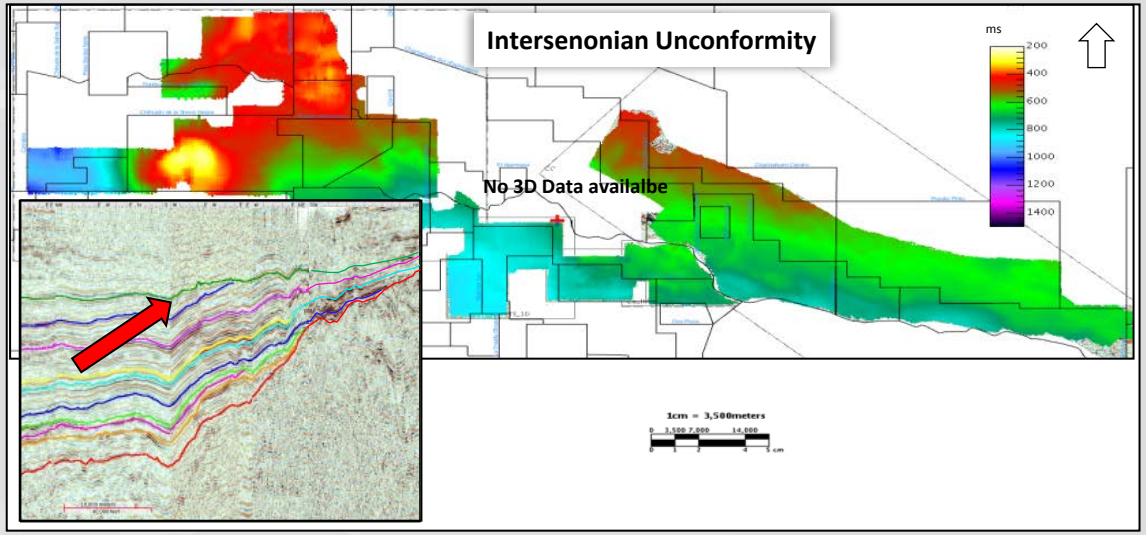
- Thickness decrease of the Jurassic and Cretaceous units to the basin border

# MACROSCALE METHODOLOGY



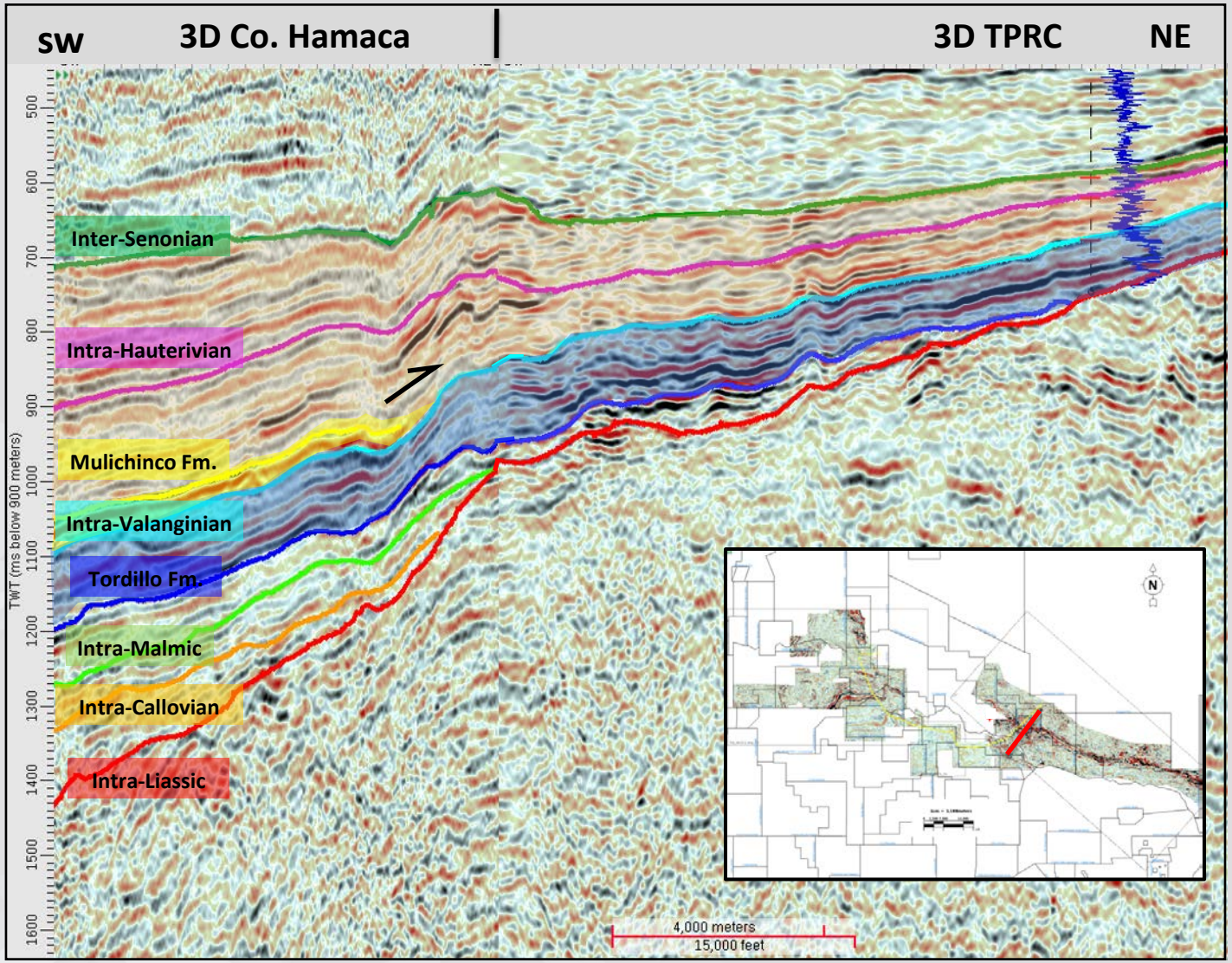



# MACROSCALE RESULTS

- Strata between the Tordillo Fm. and the Intravalanginian unconformity was assigned to the Loma Montosa Fm. based on temporal span and lithologic characteristics

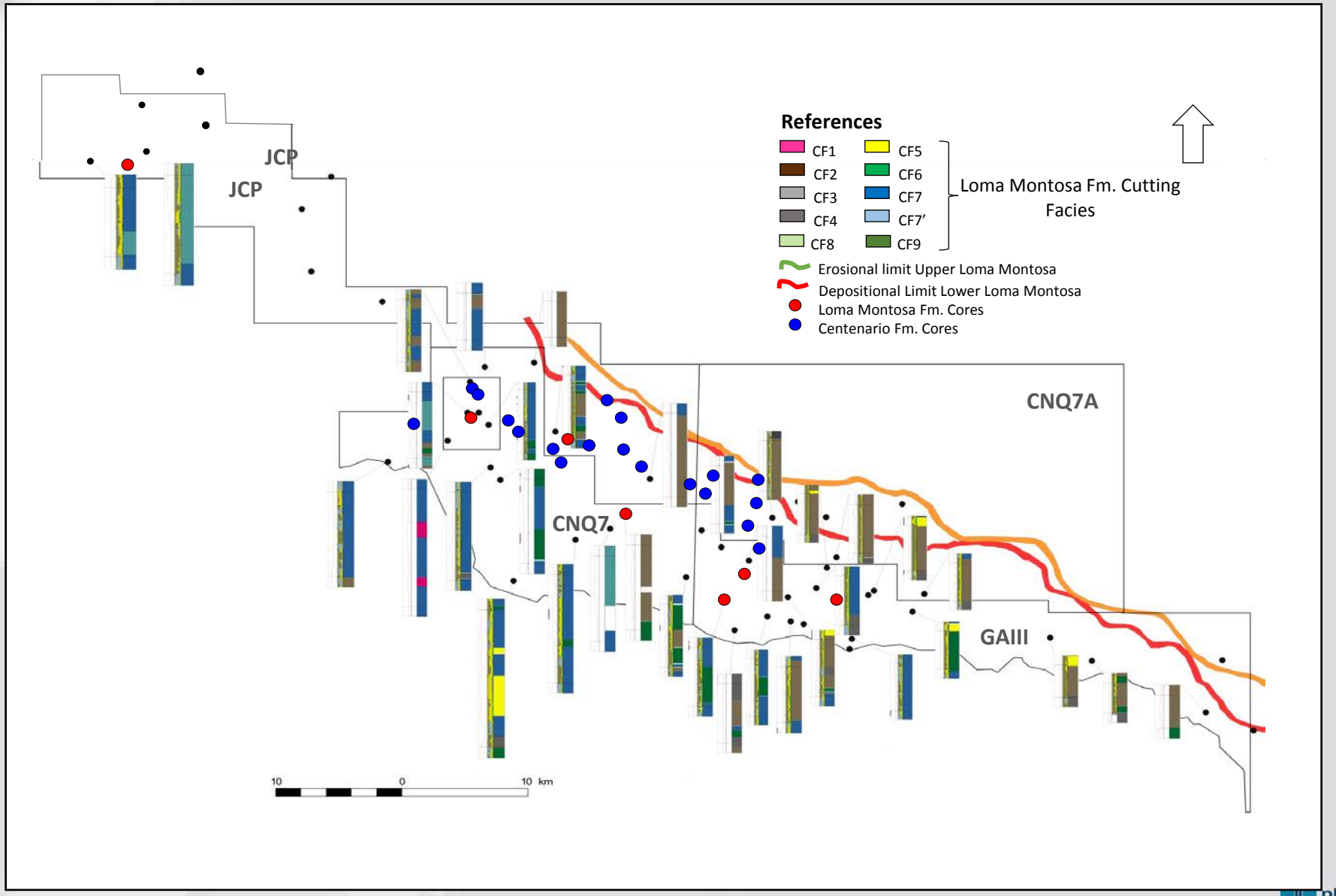
- It was confirmed that the Avile Mb. is not present and the Intravalangianian-Intersenonian interval was assigned to the Lower and Upper Mbs. of the Centenario Fm.




Meso & Microscale

# MESO & MICROSCALE METHODOLOGY

- Sedimentologic studies over 30 cores both from Loma Montosa & Centenario Fms.
- Facies and vertical successions were defined
- Integration of these data with well logs and cutting



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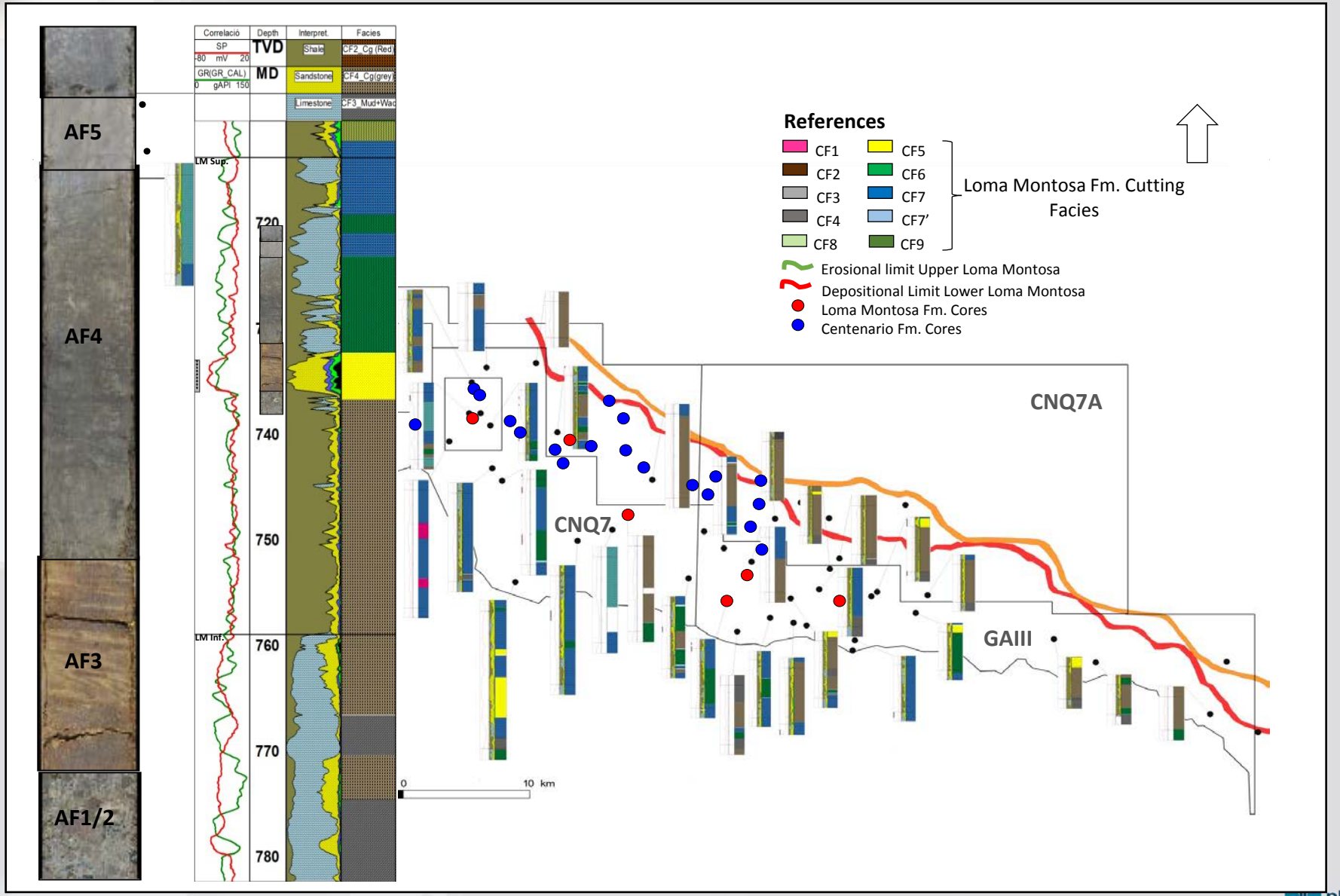

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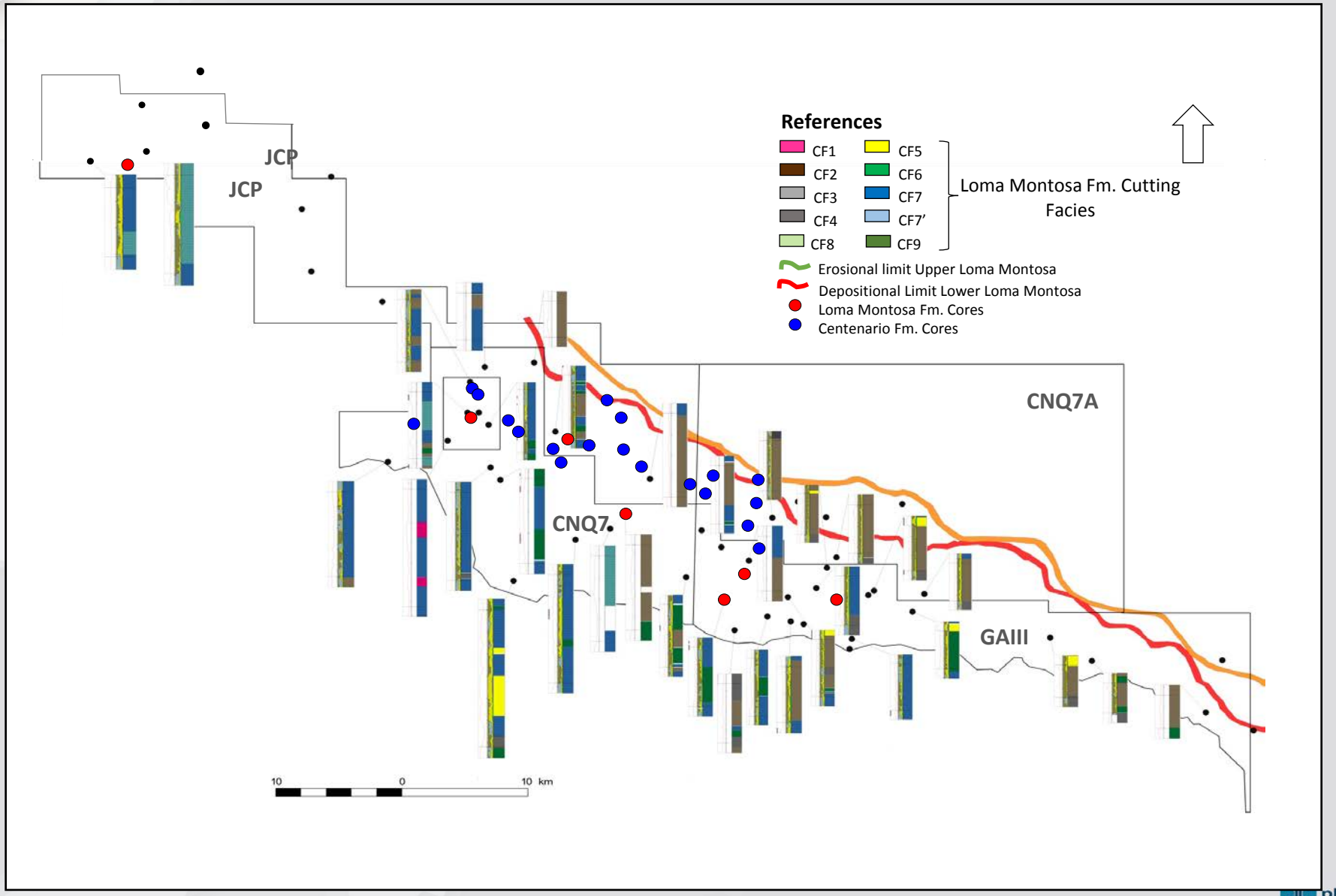
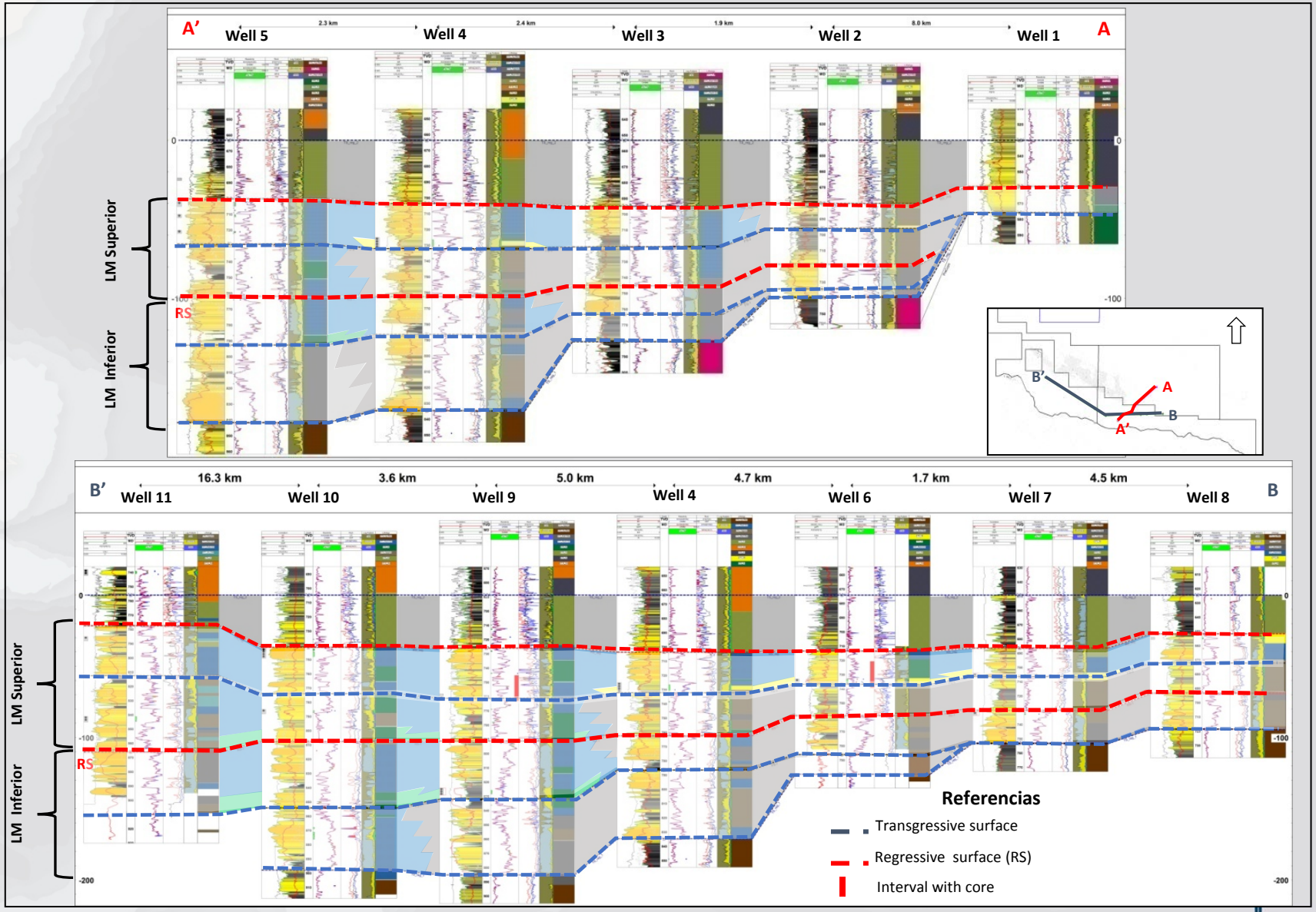


# MESO & MACROSCALE RESULTS

- Loma Montosa Fm. is limited in its base by a regional transgressive surface

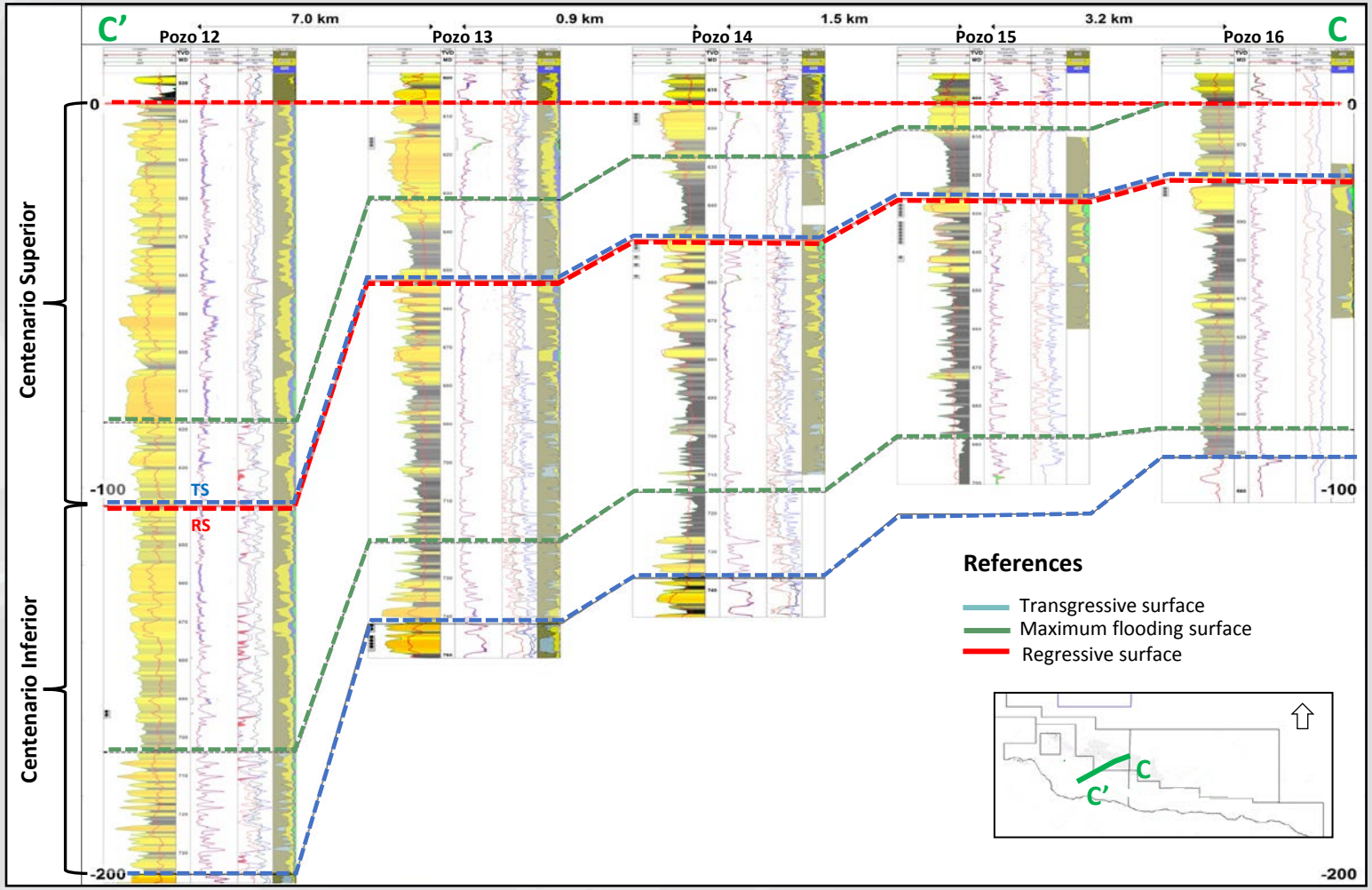
- At least one regressive and two lower hierarchy transgressive surfaces were additionally defined within Loma Montosa Cycle



# MESO & MACROSCALE RESULTS

- Centenario Fm. is limited at its base by a transgressive surface

- A coplanar R-T surface coincident with the Intra-Hauterivian Unconformity divides both Members



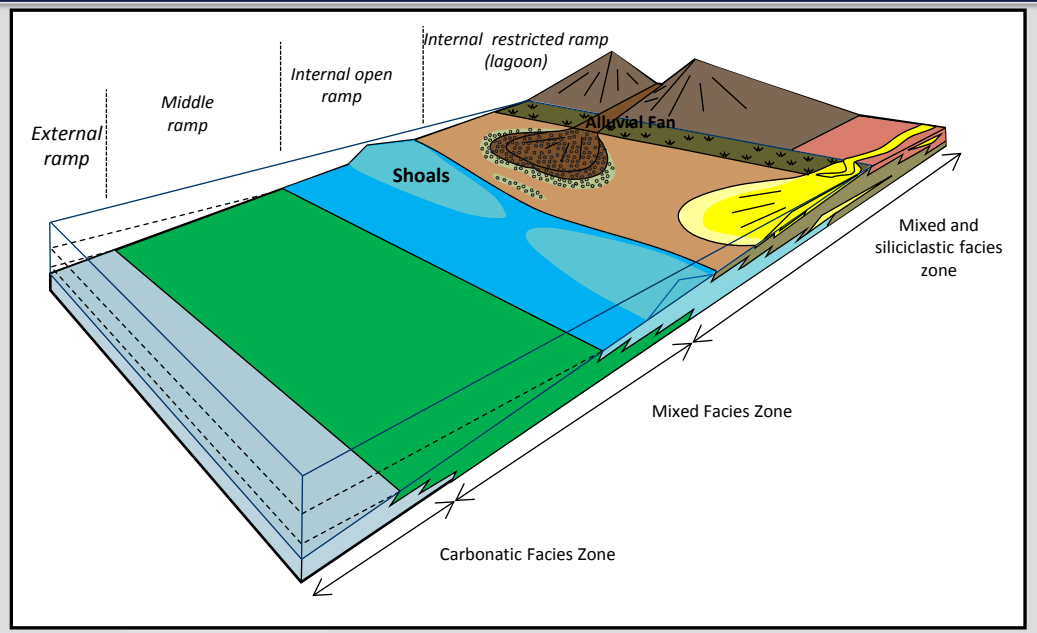

Scales Integration

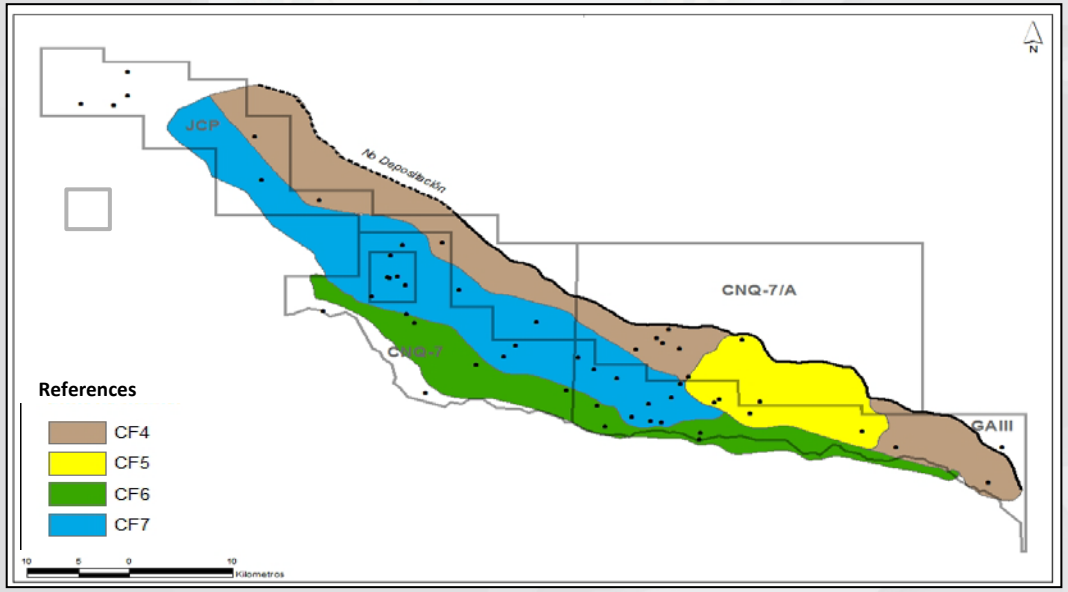
# SCALES INTEGRATION

- The studied interval is associated to mixed sedimentation systems, developed on a ramp

- Development of lagoon regions with concentration of siliclastic sediments

- In deeper positions, carbonate dominated bars associated to the shallow ramp





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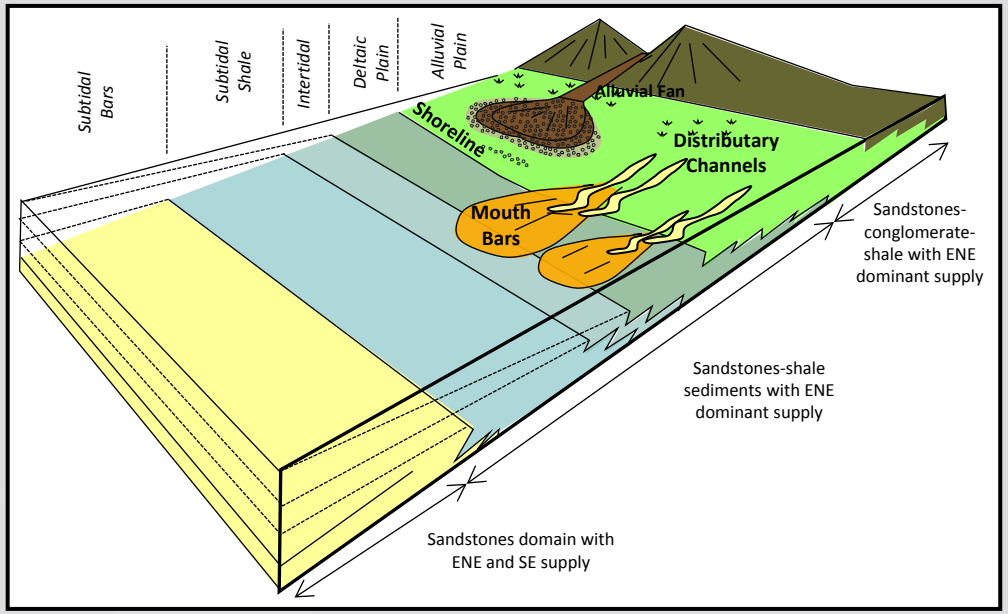
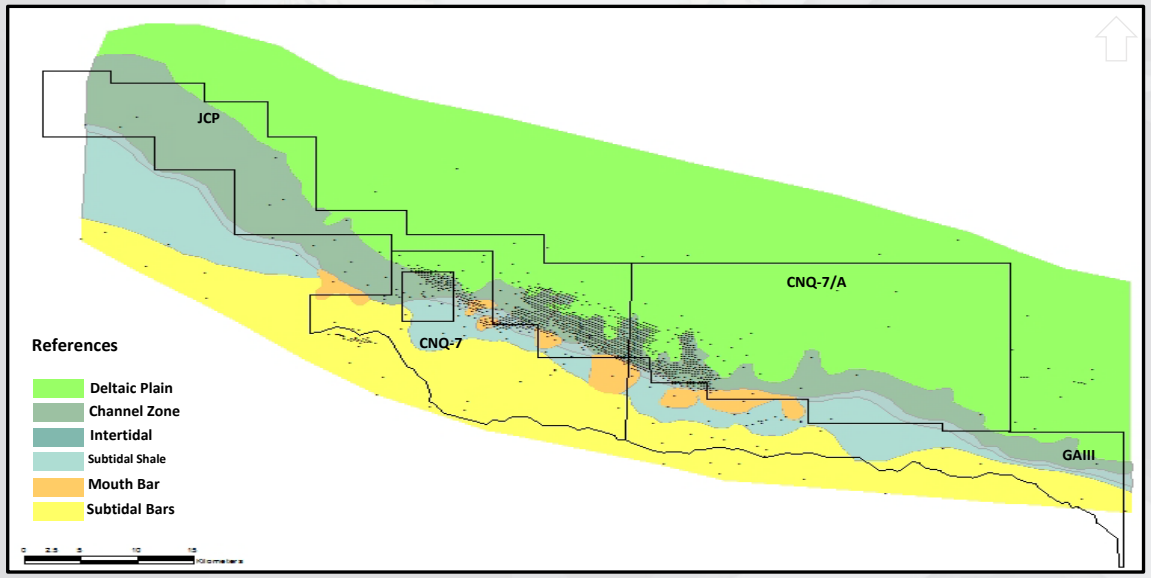
# SCALES INTEGRATION

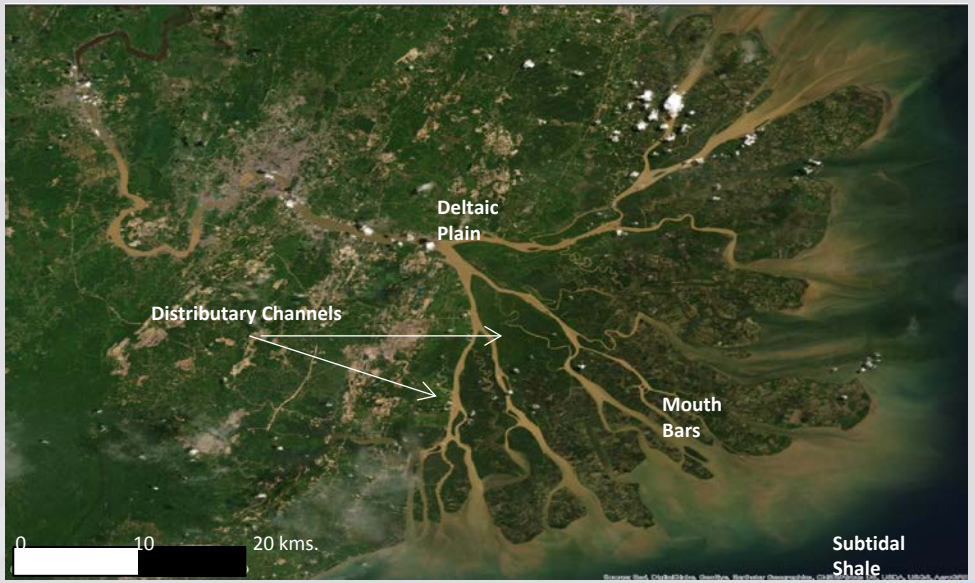
- The interval is interpreted as a paralic sedimentation system, related tide/wave dominated deltas

- Development of distributary channels in proximal regions

- In deeper positions, subtidal bars with mixed source input is interpreted



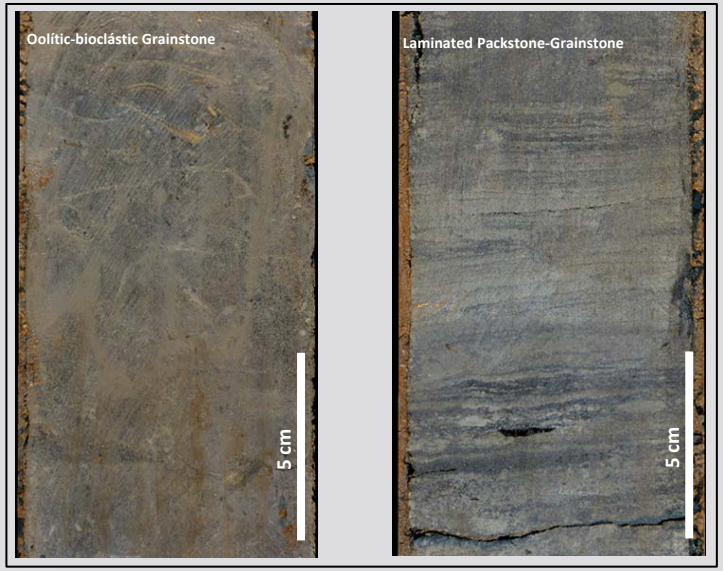



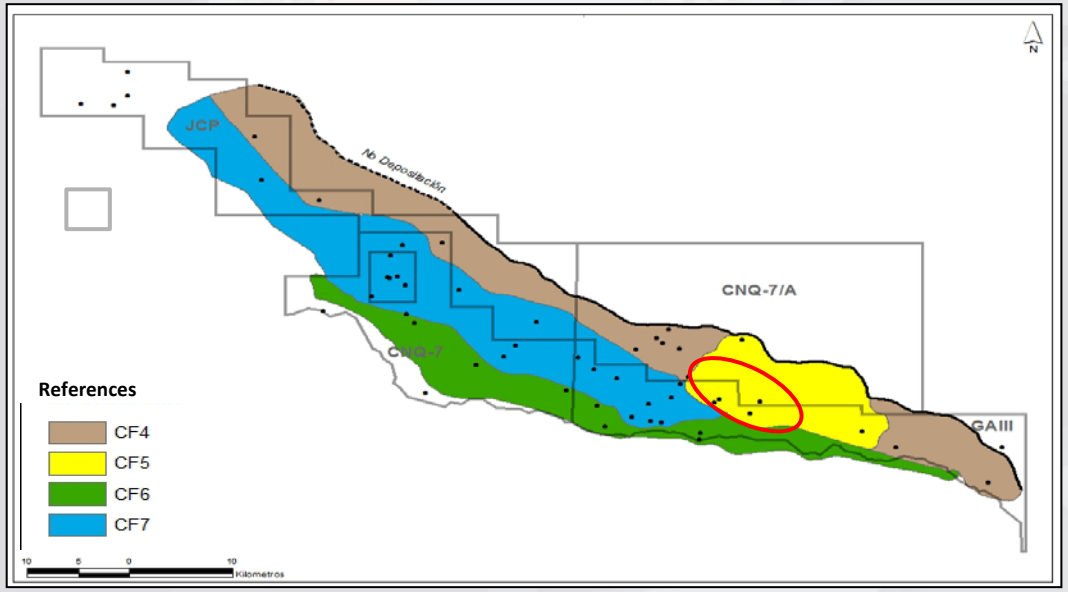



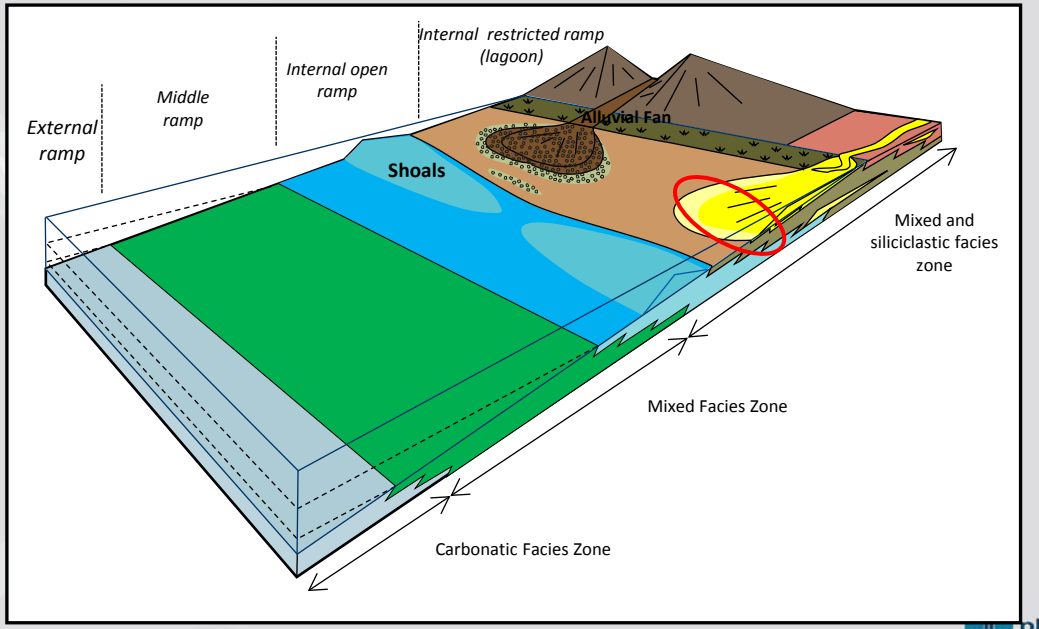
# Hydrocarbon Potential

# LOMA MONTOSA PLAY

- Two plays are considered for the Loma Montosa Fm.:
  - Siliclastic sandstones in lobes going into a lagoon and associated to terminal channels
  - Carbonatic high energy facies given by grainstones & packstones at the inner ramp

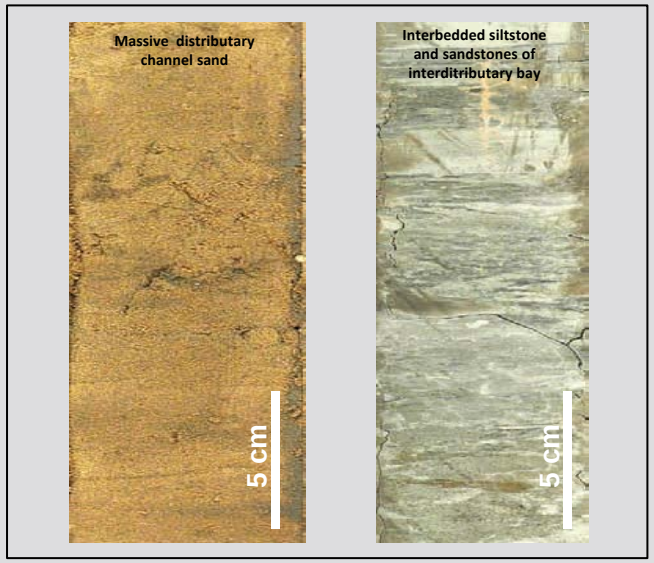


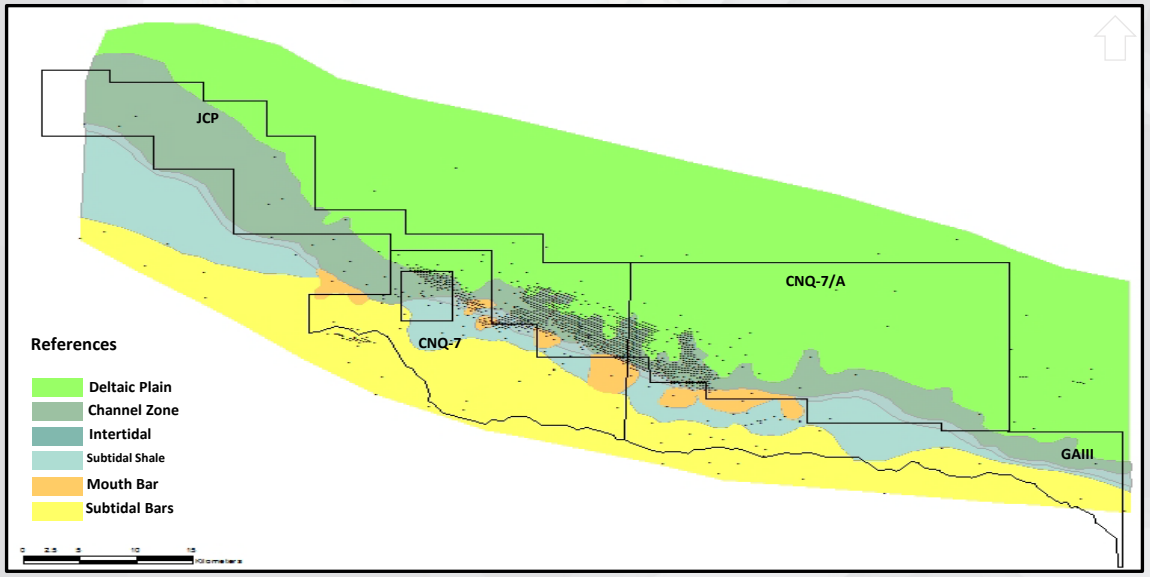



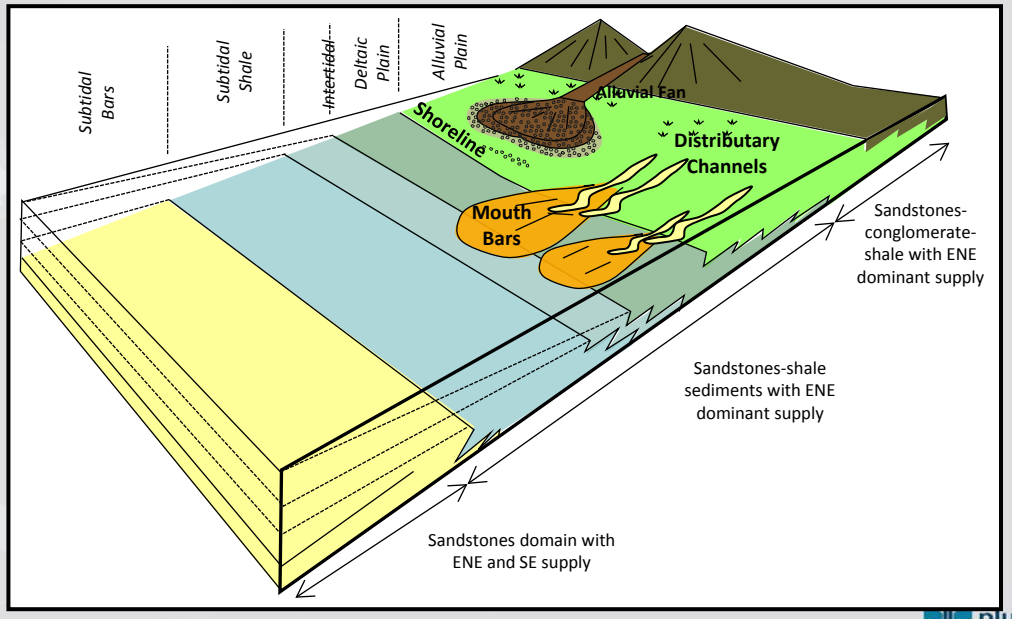



# CENTENARIO PLAY

- Centenario Fm. plays are represented by:
  - Stratigraphic traps both related to truncations and shale out in proximal positions
  - Structural traps in distal positions where subtidal bars are present



# CONCLUSIONS

1- A study that extended through multiple working scales allowed defining a Valangian-Santonian carbonate-siliciclastic interval within the chronostratigraphic framework of the Neuquen Basin, assigning it to Loma Montosa & Centenario Formations

2- Facies characterization, its paleoenvironmental interpretation, in addition to its vertical and geographical arrangement allowed us defining potential reservoir facies distribution.

3- Even when each unit presents particular challenges from the hydrocarbon exploration point of view, the multiscale approach presented here constitutes a working methodology that allows arriving to better geologic models for the definition of new plays in both mature and immature explorations zones.

4- For those blocks that constitute the RCPT, this methodology helped us in identifying remaining potential both for the Loma Montosa and Centenario Formations.

# AKNOWLEDGMENTS

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