

**PS Basin Scale Study of a Tight Gas Reservoir: Paleoenvironmental Evolution of a Shallow Marine System in the Early-Middle Jurassic, Neuquén Basin, Argentina\***

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**Abstract**

The early-middle Jurassic Cuyo Group of the Neuquén Basin has great potential as tight sand reservoir. The sedimentary succession of up to 2500 m thick shows significant variations from deep marine, shelf-margin to inner-shelf deltaic and fluvial systems. An integrated understanding of the sedimentary system/facies distribution in a regional framework is essential to identify potential gas targets. This study discusses the impact of a regional conceptual model on the potential development of this tight gas unit at exploration and development scales.

A basin scale interpretation was performed on the integration of an extensive subsurface database including 15000 km<sup>2</sup> of 3D seismic surveys and available well data such as cores, logs, thin sections, biostratigraphy, zircon dating and production data. Ten depositional prograding seismic sequences were identified. Each cycle exhibits a different shelf-to-slope arrangement as the basin progressively got filled in a northwest/west direction. Paleogeography and facies distribution evolved through time from a shallow, low- gradient ramp setting during early basin configuration, to a well-defined shelf-to-slope profile that persisted until the basin shrinkage.

Four regional schematic cross-sections show the main stratigraphic discontinuities, variations of internal geometries within each cycle, and changes in the supply-accommodation space relationships. These sections together with the isochronous maps of each cycle were used as inputs to build regional facies maps that document the evolution of the sedimentary infill. Outcrops located in the western margin of the Neuquén Basin show a complete source-to-sink profile, providing a unique analog to validate the interpretation of the subsurface conceptual model. Biostratigraphy and zircon dating linked outcrop and subsurface time intervals. Dating of the main stratigraphic surfaces allowed us to extrapolate our interpretation of the architectural elements and their geometrical relationships to areas with limited well data.

The proposed conceptual model shows for the first time the chronostratigraphic relationships between deep marine, shelf-margin and continental facies of the Cuyo Group at the basin scale. Paleogeographic reconstructions of the main facies belts in time and space will open new exploration and development opportunities for this tight gas system.

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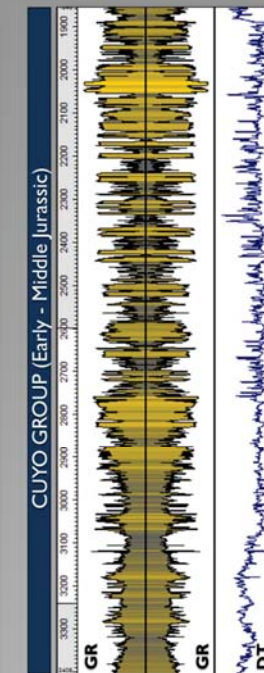
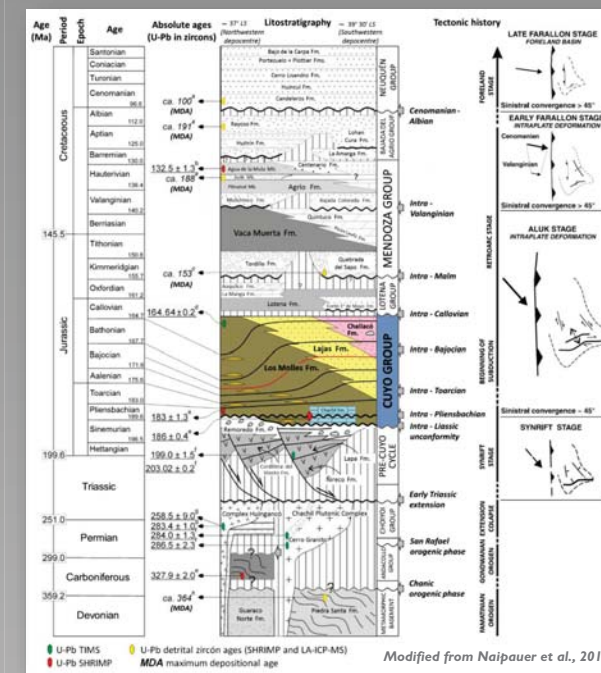
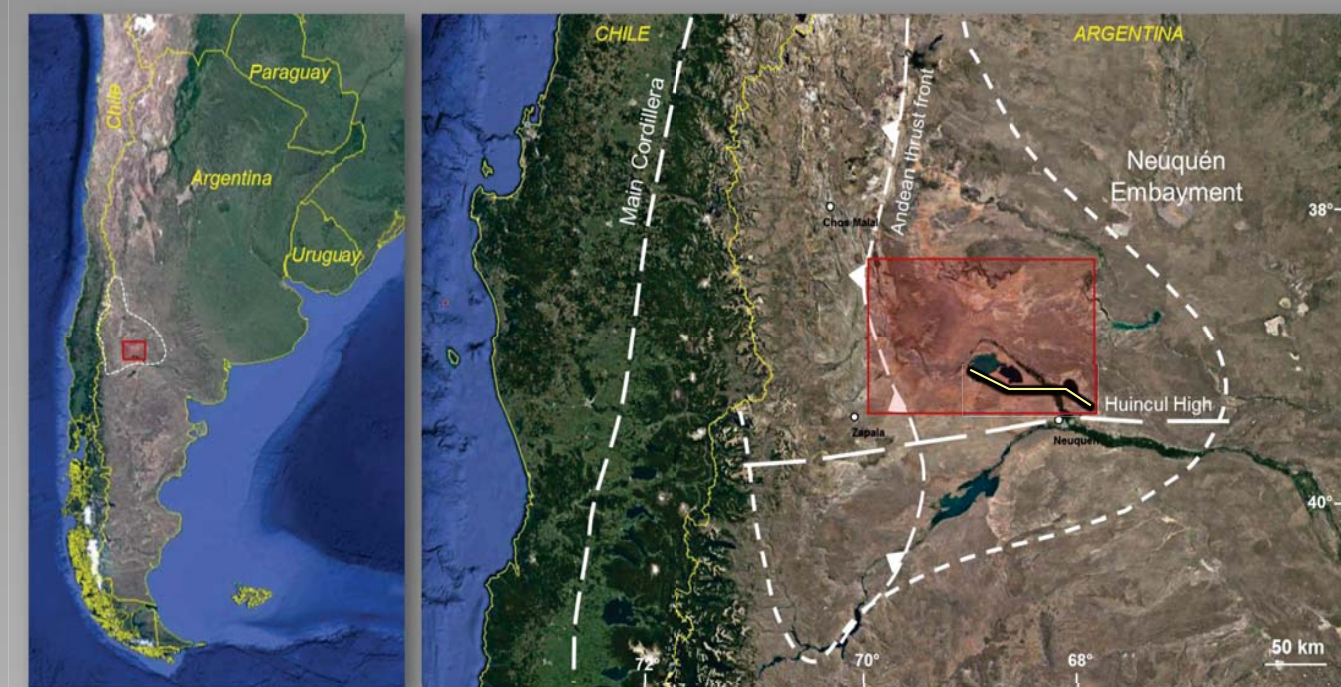
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## LOCATION

## STRATIGRAPHY

## CUYO GROUP TIGHT GAS RESERVOIR



FLUVIAL

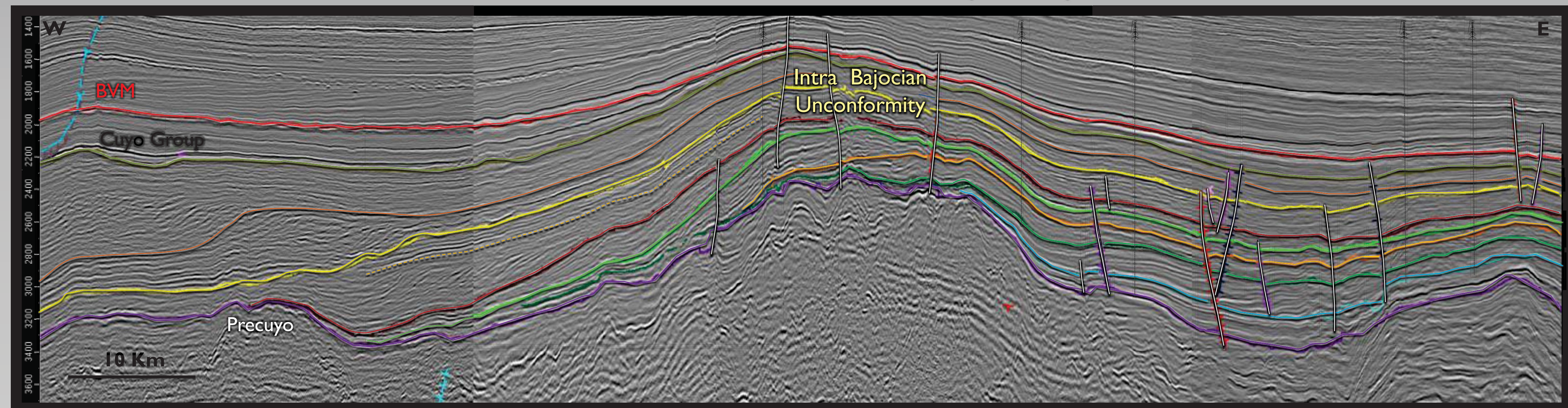
DELTA PLAIN

SHELF MARGIN DELTAS

BASIN FLOOR

- The Early-Middle Jurassic deposits constitutes the initial filling of the Neuquén backarc basin -mostly SAG phase-
- Regional seismostratigraphic interpretation shows basinward progradation of well-developed shelf-margin clinoforms that link deep-water fans, muddy slopes, incised and shelf-delta systems
- Main Plays: FANS - SHELF MARGIN DELTAS - FLUVIAL DEPOSITS
- Source Rock: MOLLES FORMATION (marlstones & siltstones)

## SEISMIC CROSS SECTION – SOUTH (SE-NW)



## KEY FINDINGS

- Identification of **GAS PLAYS**: understanding the sedimentary system within a regional framework
- Regional conceptual model that impacted the development of the Cuyo Group tight gas reservoir at exploration & development scales

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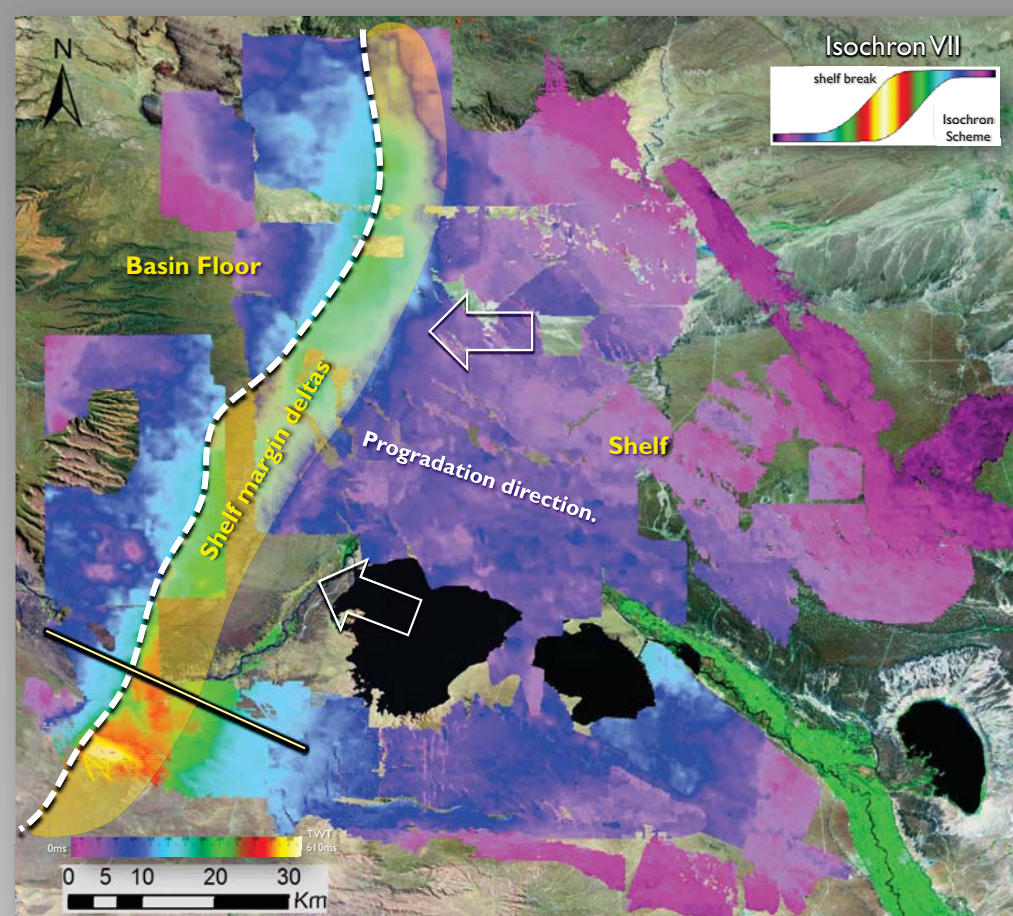
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## DATA SET & INTERPRETATION

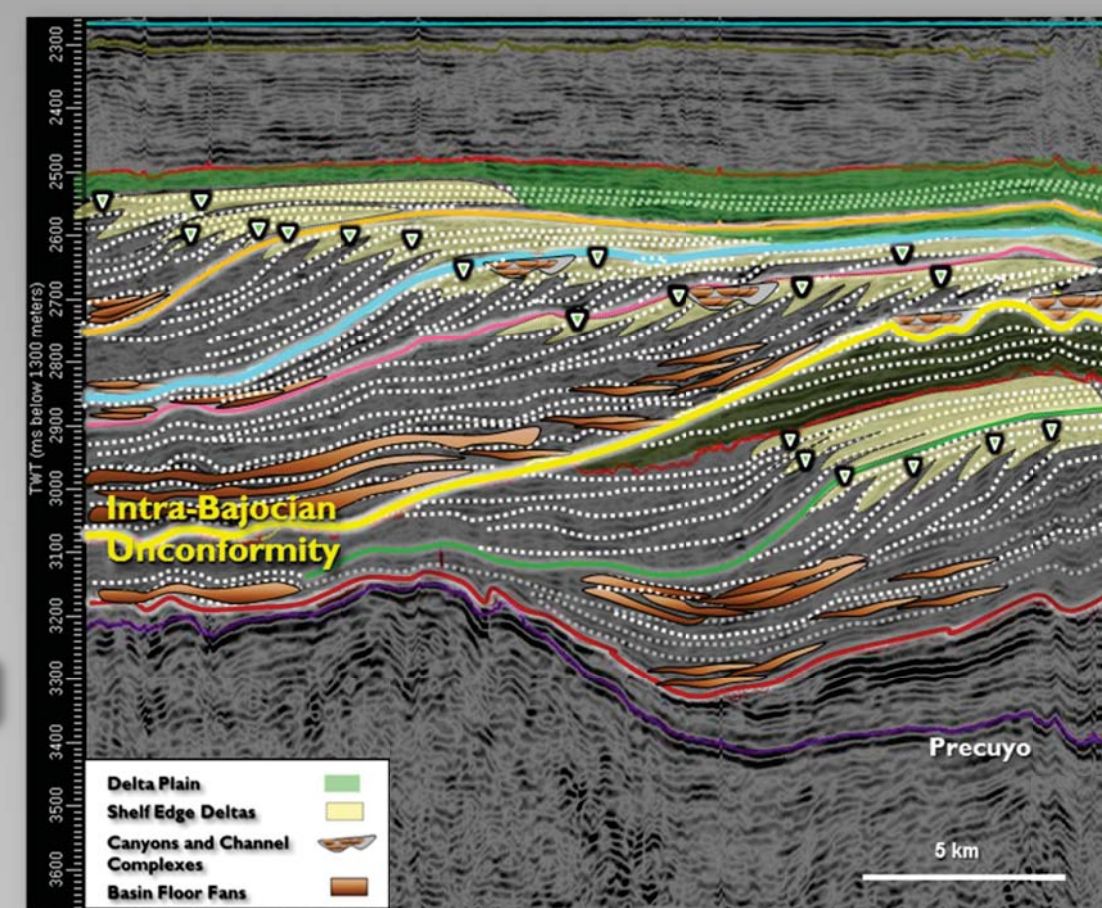
### SEISMIC DATA

#### ISOCHRON MAP



Isochrons map showing the areal distribution of main depositional cycles

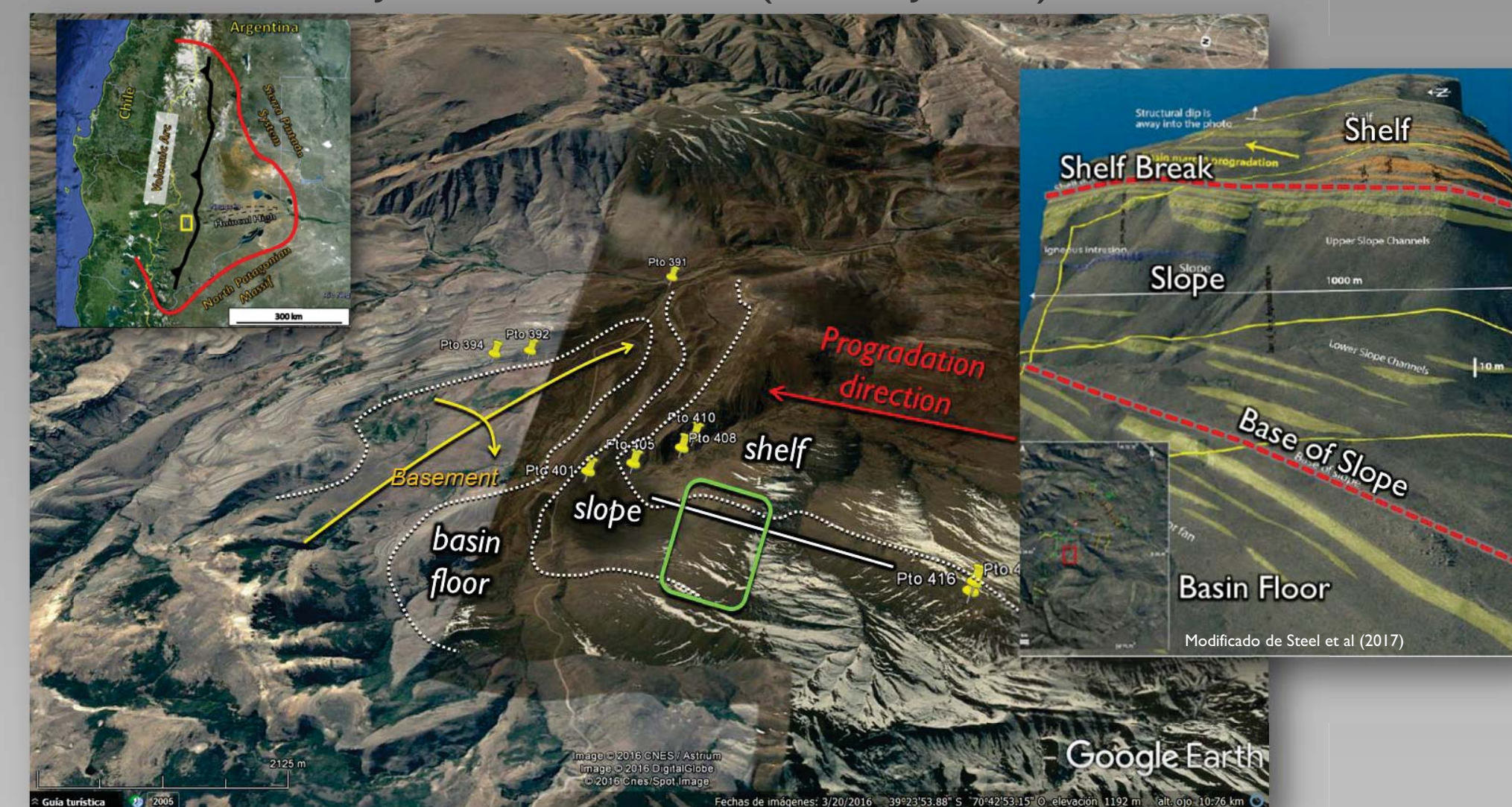
#### SEISMIC CROSS SECTION



Chronostratigraphic evolution of the northwestward prograding shelf margin system for the E-M Jurassic (Molles + Lajas Units)

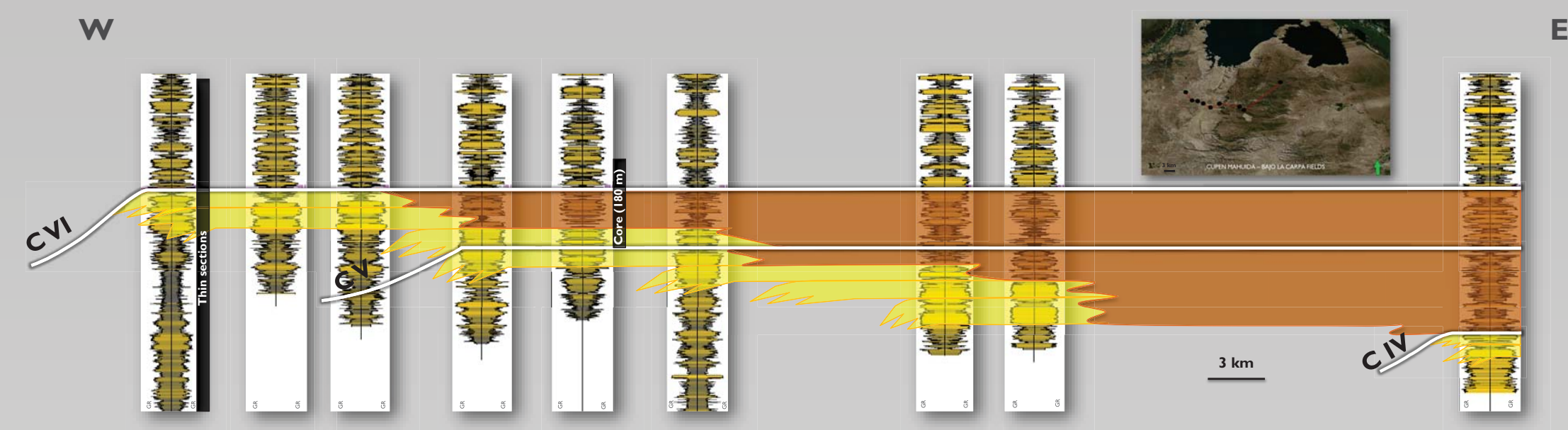
### 3D OUTCROPS EXPOSURES (DIP & STRIKE)

#### LA JARDINERA OUTCROP (LATE BAJOCIAN)



Outcrop analogs (40 km west of the study area) display similar geometries and facies distribution to those calibrated with subsurface data

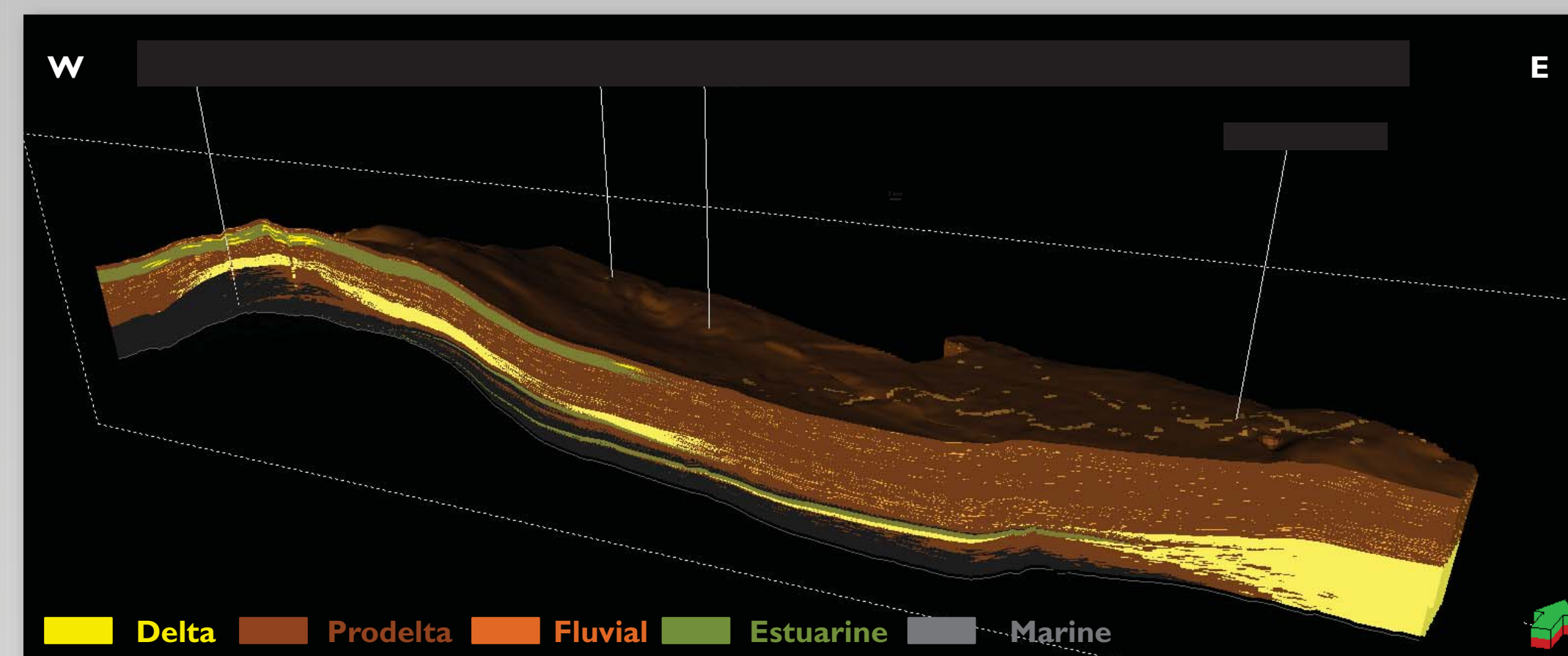
### WELLS



Chronostratigraphic correlation shows:

- shelf margin deltas
- progradation direction
- facies distribution within high frequency cycles

### 3D GEOLOGICAL MODEL



Facies model built from subsurface data interpretation can be used to predict areas without data

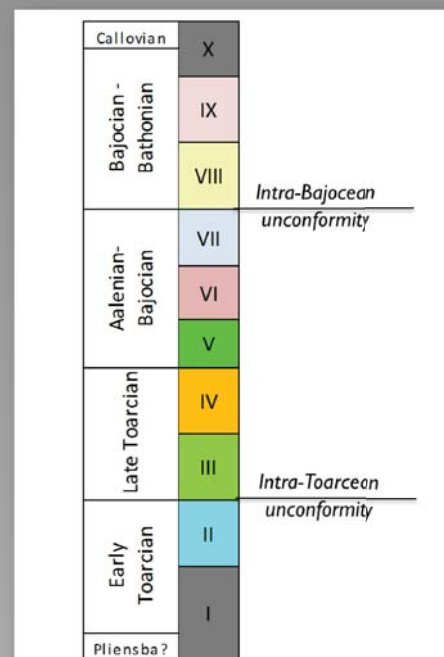
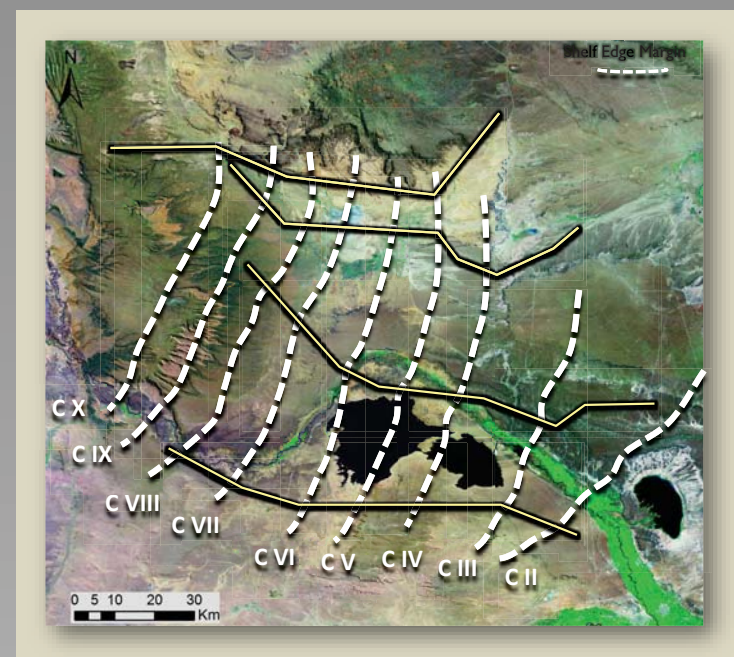
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## REGIONAL CROSS-SECTIONS

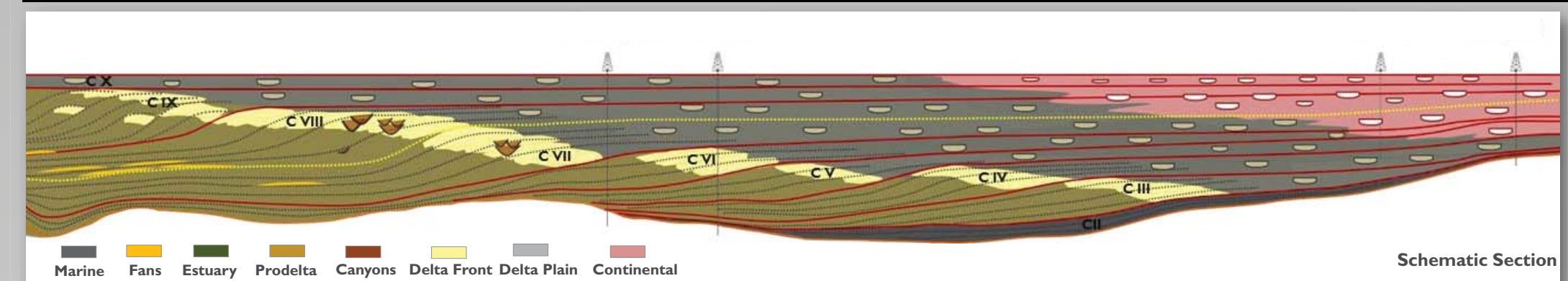
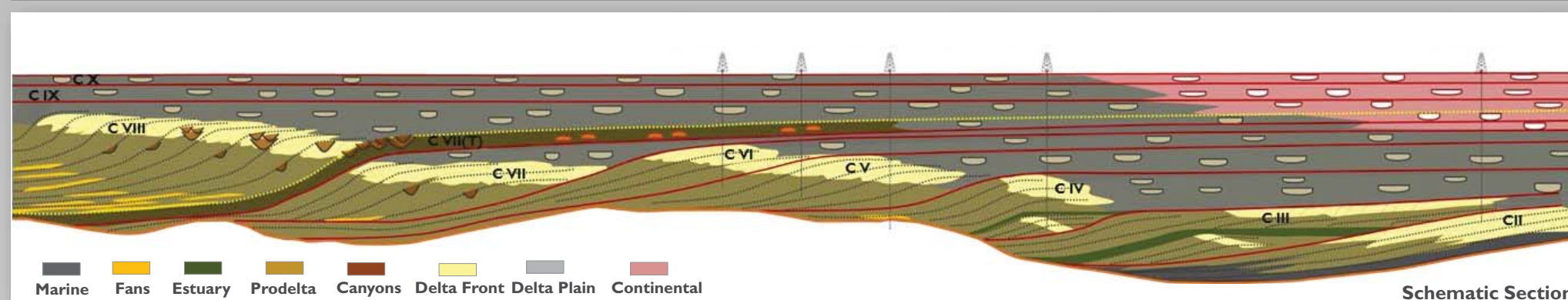
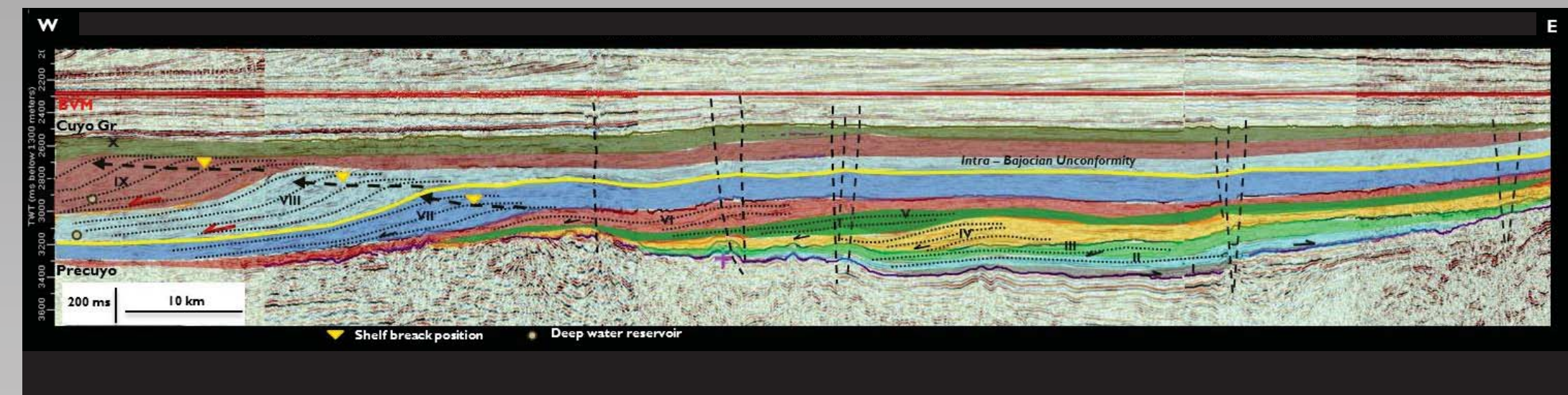
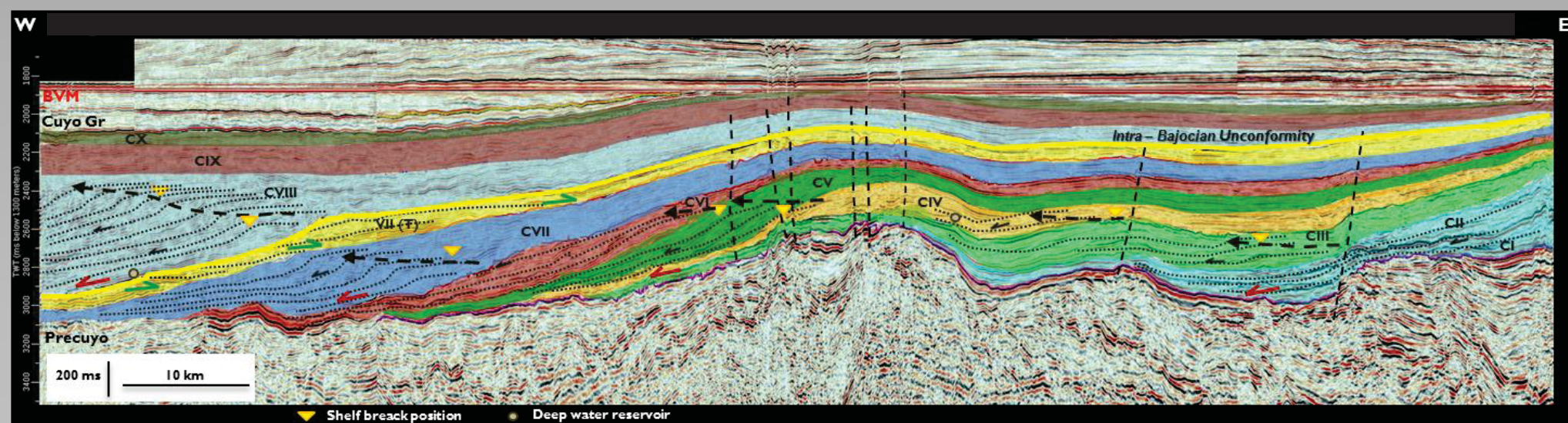


Four regional schematic cross-sections show

- strong progradation pattern
- main stratigraphic discontinuities (Intra-Toarcian, Intra-Bajocian)
- variations of internal geometries within each depositional cycle
- changes in supply-accommodation relationships

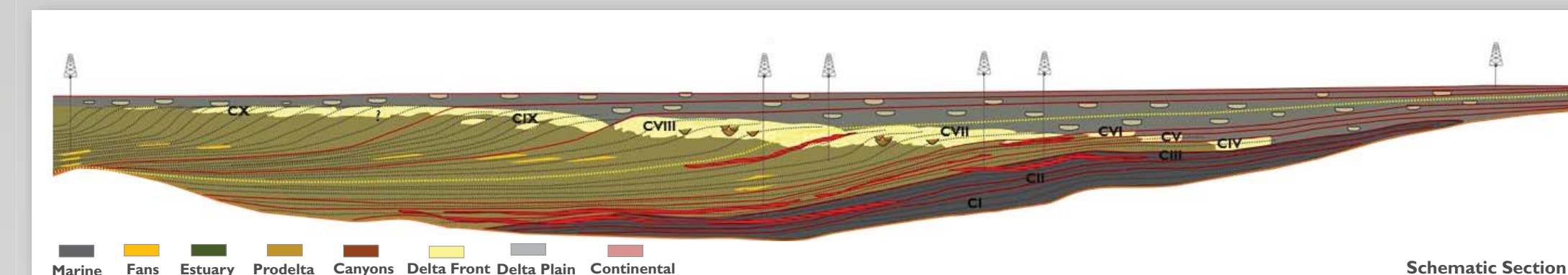
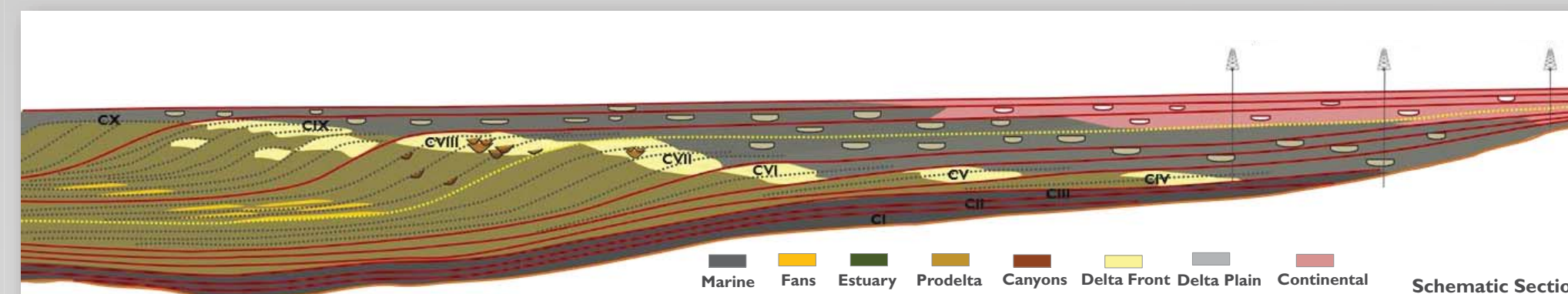
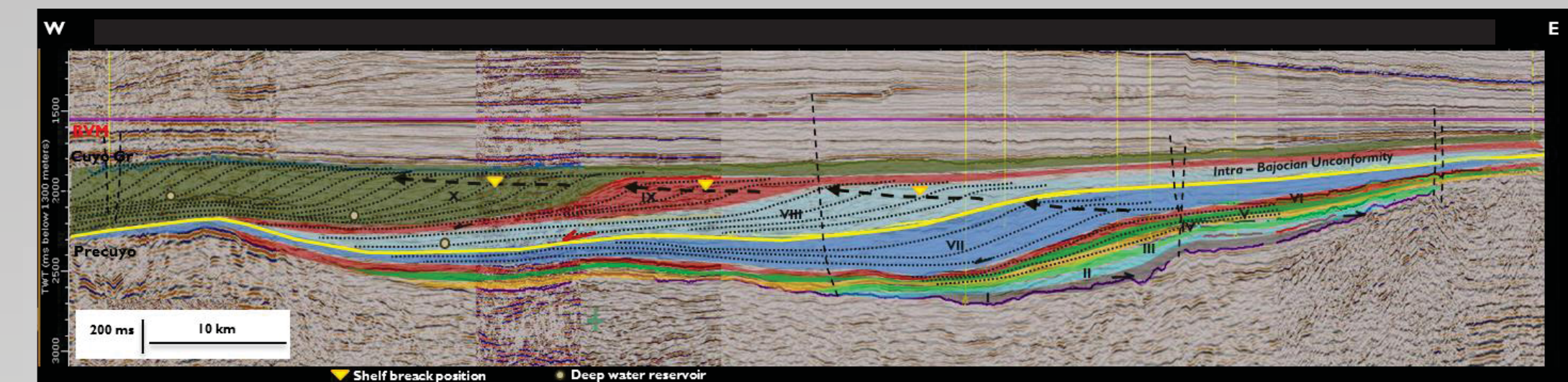
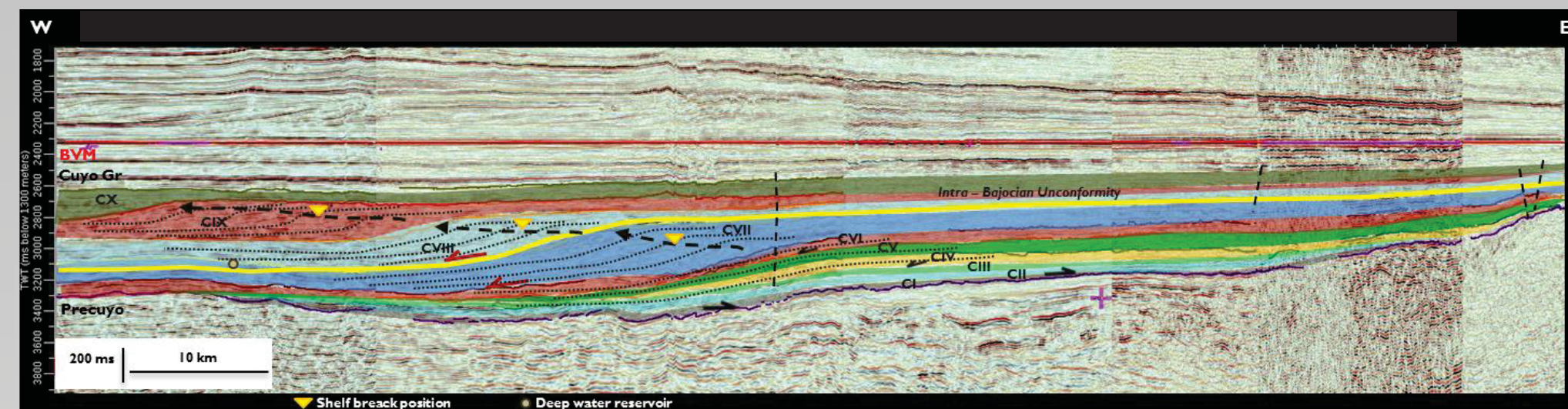
### SOUTH SECTION

### SOUTH CENTER SECTION



### NORTH CENTER SECTION

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## CONCLUSIONS

- Conceptual model shows for the first time the chronostratigraphic relationship between deep-marine, shelf-margin and continental facies of the Cuyo Group at basin scale
- Paleogeographic reconstructions of main facies belts in time and space opened new exploration & development opportunities for this tight gas system

Callovian (CX)

Bathonian (CIX)

Bajocian-Bathonian (CVIII)

Aalenian-Bajocian (CVII-T)

Aalenian-Bajocian (CVII)

Aalenian (CVI)

Late Toarcian (CV)

Late Toarcian (CIV)

Early Toarcian (CIII)

Early Toarcian (CII)

