Case Study

Neuquén Embayment

The Neuquén basin is well-known for its petroleum system in Argentina. Its depositional history was primarily influenced by changes in relative sea-level from the Triassic to the late Jurassic, leading up to the occurrence of submarine and subaerial deposits.

Location:
Neuquén Basin, Argentina

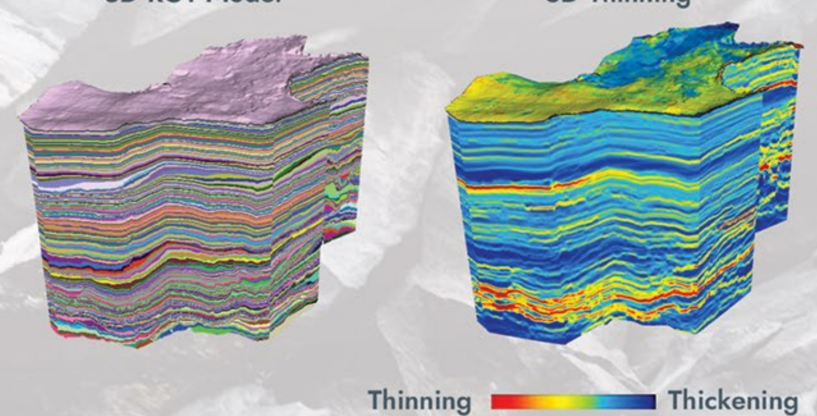
Surface area:
700 km²

Age of sediment:
Jurassic, from mid Lias to late Dogger

Geological context:
Back-arc basin, post rifting thermal subsidence, short platform & slope

Depositional environment:
Deep marine (Cuyo group, Los Molles reservoir formation)

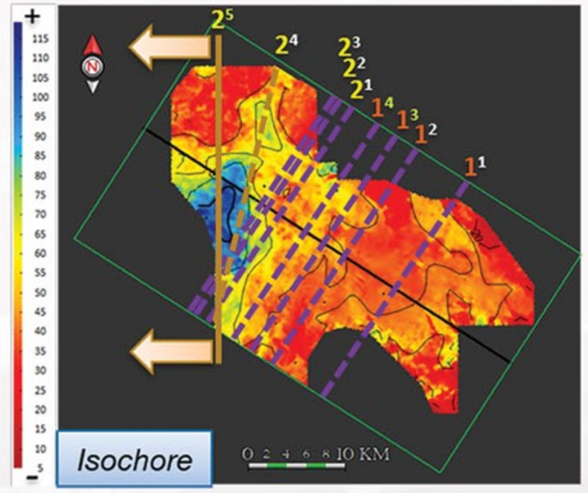
Main challenges:
Small scale turbidite system, multi-source and multi-directional sedimentary supply and flow



From Relative Geological Time to instantaneous rate of deposition

The first derivative of the RGT model delivers the Thinning attribute. A maximum of Thinning (red color) can be interpreted as a zone of strata convergence. It highlights stacking pattern changes (progradation, degradation, aggradation, retrogradation), helps delineating key stratigraphic surfaces (discontinuities, unconformities, condensed sections), and emphasizes variations of accommodation space.

From Sequence Stratigraphy to Sediment Fairway



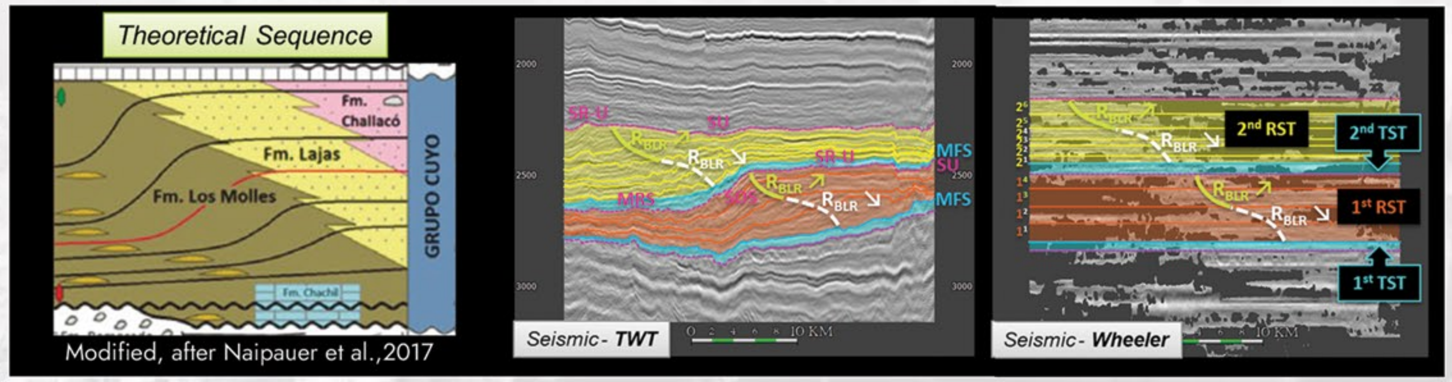
Depositional Trends

Map of isochore data computed from parasequence 2⁵ (5th parasequence of 2nd RST), matched with the location of the greatest foreset high for each parasequence from both 1st and 2nd RST. The maximum of vertical thickness (blue color) shows the depocenter where deep sea fan lobes are deposited for parasequence 2⁵.

Over the 2nd RST, the source of the sediment supply is translated from a Southeast-Northwest axis to an East-West axis.

Dashed purple line: normal to the initial sediment supply direction
Dashed brown line: normal to the transitional sediment supply direction
Solid brown line: normal to the final sediment supply direction

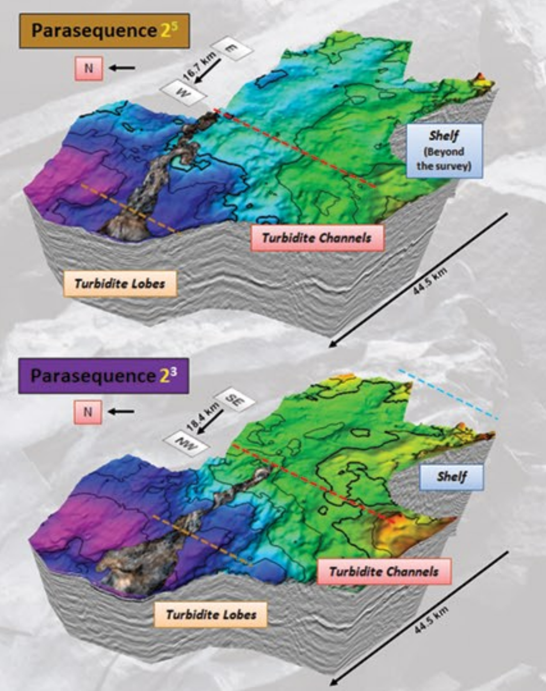
Wheeler transform & 3D sequence stratigraphic model

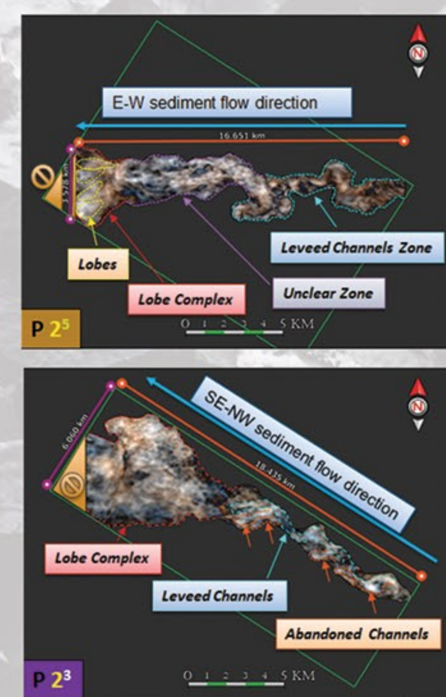


TST = Transgressive Systems Tract (light blue)
RST = Regressive Systems Tract (one orange with 4 parasequences from 1¹ to 1⁴, one yellow with 6 parasequences from 2¹ to 2⁶)
SU = Subaerial Unconformity
SR-U = Shoreline Ravinement – Unconformity
SOS = Slope Onlap Surface
MRS = Maximum Regressive Surface
MFS = Maximum Flooding Surface

Key stratigraphic surfaces and systems tracts are based on Ashton Embry's model (2009), with a landward-basinward combination of SU/SR-U/SOS/MRS. Two cycles of base level variations are identified with a northwestward shift of the location of deposition from the first RST to the second one.

The stacking pattern of each RST shows an early dominant progradation component and a late dominant aggradation component.
R_{BLR} ↘= rate of Base Level Rise is lower than rate of Sediment Deposition, and decreases (dashed white line)
R_{BLR} ↗= rate of Base Level Rise is lower than rate of Sediment Deposition, but increases (solid light green line)





Seismic data is courtesy of YPF

Depositional System

RGB-blended magnitudes (31Hz-36Hz-41Hz) reveal a deep sea fan system located at the bottomsets of the second RST.
Various geomorphological elements are identified for each growth phase of the turbidite system, including:

- Parasequence 2³:
northwestward progradation, abandoned slope channels that are stacked with a dominant channel, a well delineated downstream canyon-mouth lobate form.

- Parasequence 2⁵:
westward progradation, channel-levee complex zone, lobe complex (distributary canyon is outside of the survey).