

Facies Distribution and Stratigraphic Architecture of Continental to Shallow-Marine Deposits on a Lowstand Wedge: Basin-Scale Analysis of the Mulichinco Formation, (Neuquén Basin, Argentina).

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Abstract

The Valanginian Mulichinco Formation represents an exceptional example of a 3rd order lowstand wedge formed after a major sea-level fall. The Mulichinco Formation comprises continental, transitional and shallow-marine deposits, but their proportion varies significantly across the basin, and from outcrops to subsurface. For many decades this prevented on generating a basin-scale evolutionary model of the unit.

In this study, the basin-scale sequence stratigraphy and stratigraphic architecture of the unit was assessed by defining regional seismic and well sections along strike. Facies and facies associations were identified in cores and well logs and then related with equivalent strata exposed in outcrops. Seismic data were key to understand facies distribution and lateral continuity.

This work proposed a new sequence stratigraphic model, in which the Mulichinco Formation evolution can be synthesized in five stages. Stage 1, immediately above a first subaerial unconformity (SU1), is represented by eolian to fluvio-eolian strata, which are truncated at their top by a new subaerial unconformity (SU2), which suggest a second basin reconfiguration. Stage 2 was accumulated basinward during relative sea-level rise. Stage 2 is composed of fluvial, coastal and shallow-marine facies. Stage 3 is characterized by the appearance of mixed (carbonate/siliciclastic) offshore and shoreface deposits. The dilution of siliciclastics and retrogradational stacking suggests a decrease in hinterland supply and transgressive conditions. Stage 4 is represented by fluvial, coastal and shallow to deep-marine facies. Stage 5 represents the shift of the fluvial system landward associated to the continuous rise in relative sea level. During this stage, the stratigraphic architecture differs from the northeastern to southwestern regions of the basin. Whereas on the northern part it evidences a regressive pattern, on the southwestern sector it suggests a transgressive trend, evidenced by the installation of estuary deposits onto previous fluvial strata. This difference could be explained by localized subsidence, triggered by a tectonic inversion pulse.

The results of this study have important implications for understanding the evolution of the oil-and-gas-bearing Mulichinco Formation of the Neuquén Basin, illustrating the complexity of depositional-environment distribution within a lowstand wedge.