3D tectono-structural analysis of Cuyo Basin tectonic inversion and its implication for oil bearing systems

A. Aguilar[1], G. Gomez[2], J. Suriano[1], L. Giambiagi[1]

[1]CONICET, IANIGLA

[2]YPF Regional Barrancas

The Cuyo Basin extends between 30 and 34°S in San Juan and Mendoza provinces (Argentina). The Middle to Late Triassic rift basin´s structural arrangement has historically been described in three productive axes: Western, Intermediate and Eastern axes. Furthermore, in the evolution of this extensional system, as well as in its ulterior development, many agents have conditioned the kinematic evolution of the depocenters, as well as their subsequent development and inversion in an active foreland context. For this work, we analyzed a 3D seismic cube of 1900 km2, and 45 wells in both the Intermediate and Eastern axes where 16 oil productive fields are located. A 3D structural approach allowed us to establish the different evolutionary stages and to develop a kinematic model. During the first stage, from the Ansian to approximately Landinian, isolated depocenters were settled. These sets of faults have mainly a NNW strike (153°) and don't affect Cacheuta Formation. The ulterior evolution of the crustal extension, from Carnian to Rhaetian, promoted that the most effective fault systems started to interact, generating an increase in the main fault movement, as well as in the tectonic subsidence and sedimentary deposition. During the synrift climax, the successful interplay between extensional faults, enabled the mechanic subsidence and the deposition of both lacustrine and fluvial systems, which represent the synrift climax. These structures also have a NNW trend (147° of strike), and have geometric arrangements in grabens, hemigrabens and occasionally, in domino. From the early Miocene, accommodation space was created, registered by the deposition of synorogenic sediments of the Cacheuta foreland basin, which is a product of the lithospheric flexure due to the tectonic loading during the progressive uplift of Principal Cordillera, Frontal Cordillera and Precordillera ranges. The thick succession of the Cacheuta basin, provided the immature kerogens enough subsidence to develop thermal maturity. In this integral analysis, we also studied the rheological discontinuities that affect not only the depocenters emplacement but also their ulterior inversion (or the lack of it), and the growth of new structures from the Miocene to the present day that played a major role in the oil systems. Additionally, subvertical sets of strike slip faults affect middle Miocene deposits. The most recent structures registered in the study area are gentle folds, with NNW trends related to deep coeval faults that show basement control. Overall, in this work we analyzed both the Intermediate and Eastern axes oil fields integral structural arrangements, and established that, although the regional dynamic prevailing stress field has evolved since the Triassic from extensional to mainly compressional in the present; only the Western Axis has registered the inversion of originally normal faults that have been inverted. Regarding to the Intermediate and Eastern axes, very few Triassic direct structures have been inverted, proving the inverting process to be a very selective mechanism. Oppositely to the classical paradigm of the Triassic discontinuities acting as a weakness plane, most of them remain perfectly preserved.