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Evolution of sedimentary architecture in retro-foreland basin: Aquitaine basin example from Paleocene to lower Eocene.

Carole Ortega, Eric Lasseur, François Guillocheau, Olivier Serrano and David malet

The Aquitaine basin located in south western Europe, is a Pyrenean retro-foreland basin. Two main phases of compression are recorded in this retro-foreland basin during the Pyrenean orogeny. A first upper Cretaceous phase corresponding to the early stage of the orogeny, and a second one usually related to a Pyrenean paroxysmal phase during the middle Eocene. During Paleocene to lower Eocene deformations are less pronounced, interpreted as a tectonically quiet period.

The aim of the study is to better constrain the sedimentary system of the Aquitaine basin during this period of Paleocene-lower Eocene, in order to discuss the evolution of the sedimentary architecture in response of the Pyrenean compression. This work is based on a compilation of a large set of subsurface data (wells logs, seismic lines and cores logs) represented by isopachs and facies map.

Three main cycles were identified during this structural quiet period:

(1) The Danian cycle, is recorded by the aggradation of carbonate reef-rimmed platform. This platform is characterized by proximal facies (oncolite carbonate and mudstone with thalassinoides) to the north, which leads to distal deposit facies southern (pelagic carbonate with globigerina and slump facies) and present a significant thickness variation linked to the platform-slope-basin morphology.

(2) The upper Selandian-Thanetian cycle follows a non-depositional/erosional surface associated with a Selandian hiatus. The base of this cycle marked the transition between the last reef rimmed platform and a carbonate ramp.

The transgressive cycle is characterized by proximal lagoon facies to the north that leads southward to distal hemipelagic facies interfingering by turbiditic Lowstand System Tracts (LST). The location of these LST is strongly controlled by inherited Danian topography.

The regressive cycle ends with a major regression associated with an erosional surface. This surface is linked with a network of canyons in the north, an important terrigenous LST and a massive erosional surface in deep basin.

We correlated this upper Thanetian major regression with a flexural deformation of the basin. In this context, the importance of terrigenous LST could be explained by the erosion of the East Pyrenean range.

(3) The lower Ypresian records the installation of mixed terrigenous-carbonated system. While the East-West progradation of siliciclastic deltas is drained into foreland basin, a carbonate condensation are developed on structural ridges, attesting the structural activation of foreland basin during lower Ypresian.

This study shows that Danian to middle Thanetian time represents a quiet tectonic period in the retro-foreland basin. During the upper Thanetian period, the compressive deformation is increasing, marked by the emersion of the northern platform, a massive LST in deep basin and a rise of terrigenous input in flexural basin (LST). This deformation associated with the Pyrenean compression continues during the Ypresian and highlights the paroxysm of the Pyrenean orogeny.

This work is included in the Gaia project founded by TIGF, BRGM and Agence de l'Eau Adour/Garonne whose aim at constrain the nature and dynamics of deep Upper Cretaceous and Tertiary aquifers of the Aquitaine basin.