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Tectono-stratigraphic evolution of the northeastern Pyrenean Foreland

Christophoul, F.¹, Ford, M.², Grool, A.², Rougier, G.² and Hemmer, L.²

¹GET, Université de Toulouse - CNRS - IRD - CNES, Avenue Edouard Belin, 31400 Toulouse, France

²CPRG, Université de Lorraine - ENSG, Rue Notre Dame des Pauvres, 54501 Vandoeuvre-lès-Nancy, France.

The Aquitaine Basin, on the northern flank of the Pyrenees has been subject to intense hydrocarbon exploration up to the 1990's. This generated a huge dataset that has remained under-exploited until now. In the framework of the Pyramid project, funded by the French National Research Agency, this dataset is combined with new field data to reconstruct the evolution of the north Pyrenean (Aquitaine) retroforeland basin.

The study of the eastern part of the basin (from the Corbières to the east to the Toulouse fault to the west) reveals a distinct history compared to the western basin which was strongly influenced by Paleozoic and Mesozoic crustal inheritance and salt tectonics.

In terms of ages, the main depocentres are however contemporary along the whole basin:

1) From Late Cretaceous to Paleocene (Campanian to Selandian) the early foreland basin, known as the "Flysch Trough" was filled by a succession of turbidites passing upward into tidal and fluvial sediments that prograded axially from the east.

2) From Thanetian to Oligocene, a second cycle started with a deepening upward trend until Ypresian (inner carbonate platform to mixed open marine) and then changed to a shallowing upward succession, passing from open marine sediments, coastal clastic deposits and then coarse fluvial deposits from Upper Ypresian to Oligocene. Progradation was again axial from the east. However, a new south to north fluvial drainage developed from the emerging relief of the Pyrenees to the south in the Ypresian.

In terms of location and structural style of depocentres, the salt-free eastern basin (east of the Toulouse fault) reveals a distinctive style compared to the salt-rich western basin. In the eastern foreland (Corbières to Aude Valley), syntectonic depocentres migrated north as a series of three wedge-top basins from the Late Cretaceous and the Late Eocene, dated by progressive unconformities. Large basement-cored anticlines form syn-sedimentary foreland highs that progressively die out to the west. In the western part of the study area (Plantaurel to Petites Pyrenees) vertically stacked depocentres of the same age are preserved in the footwall of the North Pyrenean Frontal Thrust. A slower northward migration is recorded by northward propagation of onlap onto the "passive" foreland platform.

Subsidence histories, derived from several boreholes along south-north transects, confirm a two stage history for the eastern foreland basin. The variation from south to north in terms of amount and timing of subsidence validate a flexural model for this retroforeland basin.

The differences in the structure and sedimentary history observed in the basin from east to west record the role played by 1) Variscan and Mesozoic inherited crustal structures in controlling the structure and subsidence of the basin; 2) Upper Triassic evaporites (Keuper) in controlling the geometry of structures, their growth history and in the paleogeography of the associated depocentres.

