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

brgm — Géosciences pour une Terre durable
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AGENCE DE L'EAU ADOUR-GARONNE — ETABLISSEMENT PUBLIC DU MINISTERE DU DEVELOPPEMENT DURABLE

1. Context

The Aquitaine basin located in south western Europe, is the Pyrenean retro-foreland basin. During the Pyrenean orogeny two main phases of compression are recorded.
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 sedimentary filling is characterized during the tectonically quiet period (Paleocene) by aggradational carbonate platforms (Fig.1), passing southward to turbiditic sedimentation. While during the Eocene (Ypresian-Priabonian) Aquitaine basin is characterized by large progradational deltaic systems (Fig.2), migrating westward.

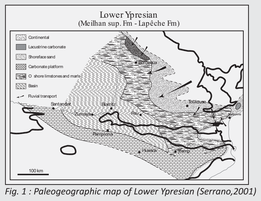


Fig. 1 : Paleogeographic map of Lower Ypresian (Serrano,2001)

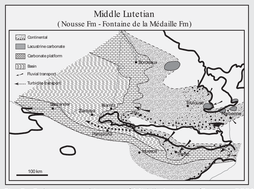


Fig. 2 : Paleogeographic map of Middle Lutetian (Serrano,2001)

2. Methodology and Objectives

The aim of this study is to better constrain the sedimentary system evolution of the Aquitaine basin during this period of Paleocene-lower Eocene and its relation to the pyrenean orogenic prism.
At the turnover from agradational carbonate platform to siliciclastic deposits in order to document the relationship between :

- **Onset of compression;**
- **Growing and exhumation of the orogenic prism;**
- **Sedimentology budgets and dynamics.**

The methodology is based on well logs correlations calibrated in age through stratigraphic wells avaible in the literature and well core logging, combinated with seismic analysis and seismic stratigraphy.

1 - Data available
- Well-logs (x300) / Cores logs (x1)
- Seismic lines (3000Km)

→ **2 - Seismic stratigraphy : Seismic correlations and sequence definitions**

→ **3 - Sequence stratigraphy : well-logs correlations and cycles definitions**

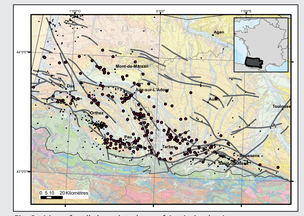


Fig. 3 : Map of wells logs data base of Aquitaine basin.

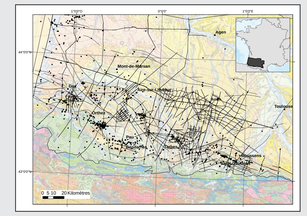


Fig. 4 : Map of Seismic data base of Aquitaine basin.

3. 2D Geometries

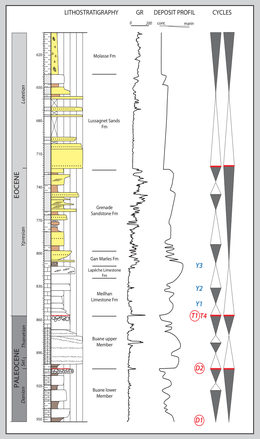
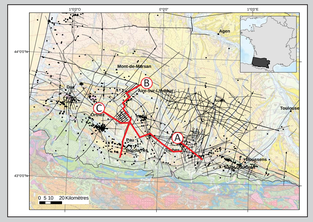
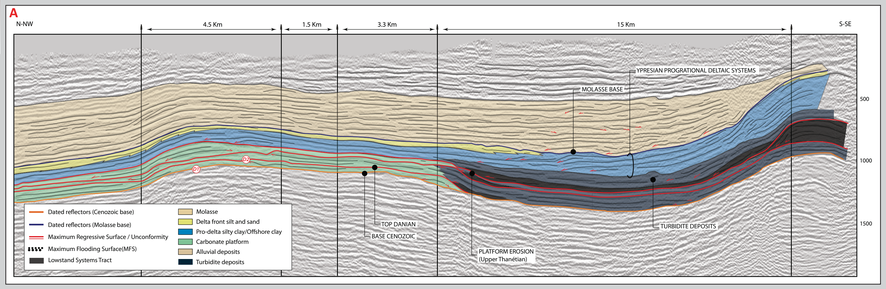


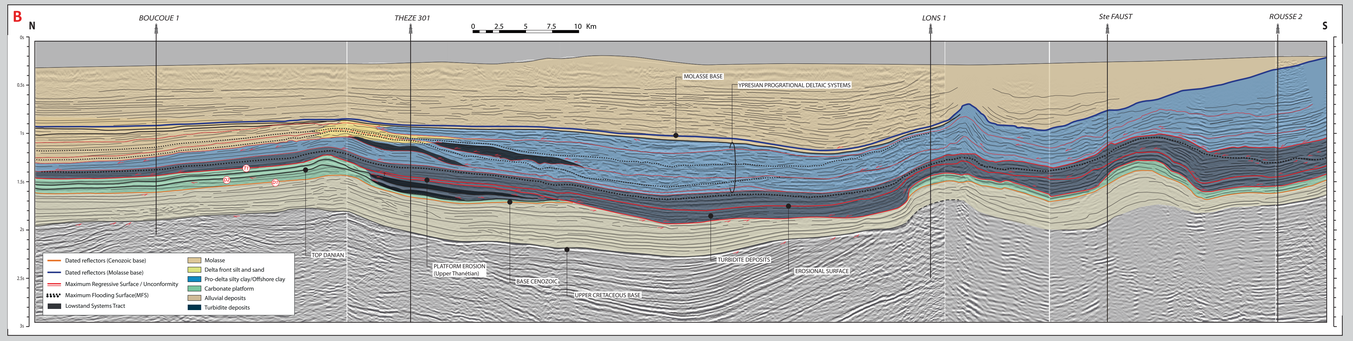
Fig. 5 : Synthetic log and stratigraphical interpretation of well core data.

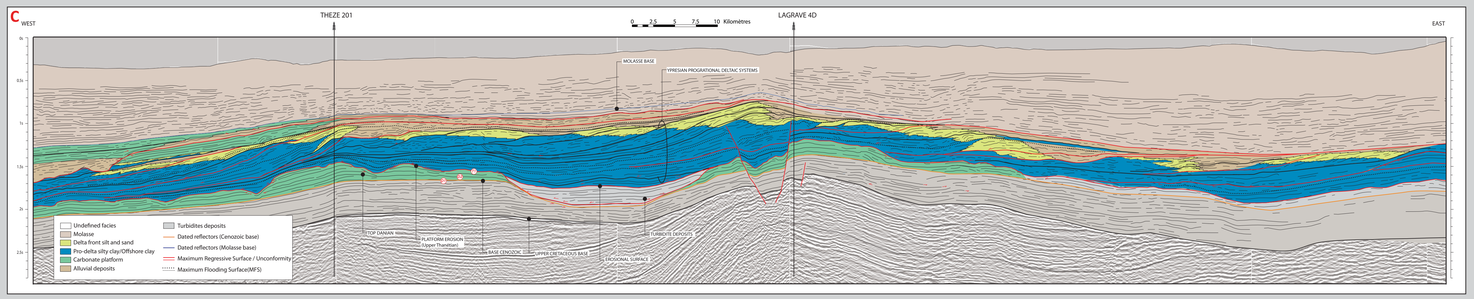
Facies and sequence stratigraphy in north basin from well core data :
Three main cycles were identified during the Paleocene - lower Ypresian, separated by emersion and strong time hiatus.

- The Danian cycle, is recorded by the aggradation of carbonate reef-rimmed platform. This platform is characterized by proximal lagoonal facies.
- The Selandian hiatus.
- The upper Selandian-Thanetian carbonate ramp (proximal lagoon faciesi.
- Upper Thanetian emersion.
- The lower Ypresian records the installation of Deltaic system.









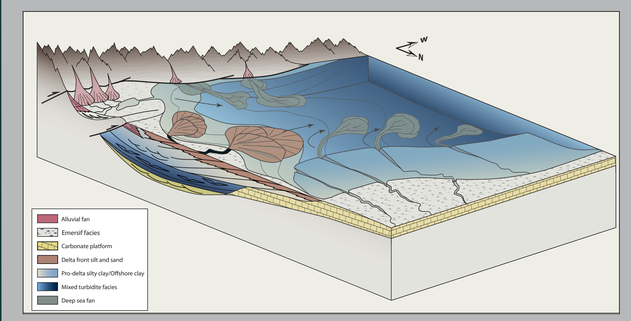
- **Danian** : reef platform morphology.
- **Upper Selandian- Thanetian** : ramp deposits and succesive lowstand carbonate turbidites (slope constrained by inherited danian morphology).
- **Upper Thanetian**:
  - Uplift and emersion of northern platform
  - Large mixed carbonate siliciclastics turbiditic systems fed by large prograding deltas.
- **Upper Thanetian to Ypresian**:
  - Paleogeographic reogarnisation and rapid infilling deep sea.
  - Emersion and erosion of local topographic high (structure inversion).
  - Prograding deltas locally N-S and mainly westward.
  - Abrupt change for carbonate to siliciclastic deposits.
  - Canyon incision and deep sea erosion.
  - Deep sea-fan (mixed siliciclastic- carbonate).

- **Upper Thanetian** :
  - Canyon incision over the carbonate platform.
- **Ypresian** :
  - Major progradation of deltaic system westward drained into foreland basin.

4. Conclusion

Paleocene-Lower Eocene corresponds to growing and exhumation phase of the orogenic prism, and these different events are directly recorded in sedimentary filling of the foreland basin:

- **Danian to middle Thanetian** time represents a quiet tectonic period in the retroforeland basin (carbonate platform aggradation).
- **Upper Thanetian** period is characterized by the onset of foreland deformation, marked by :
  - Emersive surface and canyon erosion of the northern platform
  - Abrupt change for carbonate to siliciclastic deposits
  - Paleogeographic reorganisation and rapid infilling in foreland basin by deep sea fan.
- **Paroxysm of the Pyrenean orogeny during the Ypresian**, recorded by major progradation of deltaic system westward linked to the erosion of the orogenic prism.



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