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Defining the syn to post-orogenic transition in the North-Pyrenean foreland basin

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The renewal of interest in Pyrenean geology in the last years has mainly focused on the pre and syn-orogenic stages of the foreland basin. More recently, studies dealing with the post-orogenic evolution (Bosch et al., 2016; Mouchené et al., 2017) have addressed the erosional history of the northern foothills. Nevertheless, the age and conditions of the syn to post-orogenic transition has still to be defined. This work aims to define 1) the age of the transition between syn to post-orogenic stages, 2) the geomorphic and sedimentary evolution of the north-Pyrenean foothills during this transition. We focused on the central Pyrenees in an area comprising the northern North Pyrenean Zone (NPZ), the Sub-Pyrenean Zone (SPZ) and the southern Carcassonne High and Aquitaine Platform. Our study is based on harmonization and updating of geological maps and new interpretations of seismic and borehole data to ensure consistency between surface and subsurface data.

Late synorogenic stage
The syn-orogenic stage of the North Pyrenean foreland started in the Upper Cretaceous (Ricateau & Vuillemin 1972 ; Ford et al., 2015 ; Rougier et al., 2016) with deep marine sedimentation passing upward to shallow marine deposits. Since Late Ilerdian, in the Central Pyrenees, sedimentation has been alluvial to fluvial (Carcassonne Gp.). The lower Carcassonne Gp (Palassou Fm., Lutetian to Bartonian) is preserved in the synclines of the SPZ. Along the northern boundary of the SPZ (Petites Pyrenees Front - PPF), the Palassou Fm, exhibits growth onlaps on the forelimbs of the northernmost folds. In the Mas d'Azil area (Plantaurel) equivalent growth onlaps affect strata up to Oligocene age. From the Late Eocene through to the Oligocene the north-Pyrenean foothill sedimentation is controlled by the PPF growth. There is no evidence of contemporary sedimentation in the SPZ. The topographic front of the Pyrenees during these times was thus located along the northern margin of the SPZ.

Syn to Post-orogenic transition
In the Plantaurel area, new geological mapping reveals that the undeformed Lower Miocene unconformably covers the late syn-orogenic series. Westward, (St Gaudens and Lannemezan area) the Miocene deposits sealing the Subpyrenean fold and thrust structures are younger (early to middle Miocene), thus showing the transition to be diachronous. These formations, sealing the structures, can be identified on seismic cross sections below the Lannemezan plateau where outcropping sediments are middle Miocene in age. The growth onlap identified in the late synorogenic series evolves to a passive onlap, indicating that the SPZ and the PPF ceased to be active in the Early Miocene.

Post-orogenic stage
Upper middle Miocene strata (Serravallian) unconformably cover the transitional series all along the Central Pyrenees. These series cover the SPZ but also the NPZ where they are preserved in the Salat and Adour valleys, showing a progressive southward backfilling of the middle Miocene foothill relief. The age of the youngest sediments preserved is not younger than Upper Serravallian (11.6 Ma) indicating that sedimentation on the foothills ended, or was removed by erosion, before the sedimentation of the much younger Lannemezan Fm.