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# Constraining the Timing and Mechanisms of Rift Inversion Along the Lakora-Orhy Thrust system (Western Pyrenees)

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## Résumé

The Lakora Thrust is the most internal and oldest south-verging structure in the western Pyrenean orogenic prism. It emplaced the North Pyrenean Zone (comprising the structures of the former lower Cretaceous rift) onto the Upper Cretaceous to Eocene cover of the Axial Zone (the Jaca foreland basin), making it pivotal for unraveling how the region transitioned from the mid-Cretaceous hyperextension to continental collision. In contrast to the more external and younger Gavarnie and Guarga thrusts which are better dated thanks to the tectono-sedimentary relationships, the Lakora frontal zone has been heavily eroded, obscuring critical tectono-sedimentary relationships and leaving its timing and kinematics poorly constrained. Our study therefore seeks to (1) establish the age of inversion along the Iberian paleo-margin and (2) refine the structural style and spatiotemporal distribution of Pyrenean compression across the thrust front. To accomplish these goals, we employed a multi-scale workflow integrating: new field mapping; deformation analyses spanning outcrop to thin section; clay-mineral investigations via mica polytypism; and  $^{40}\text{Ar}/^{39}\text{Ar}$  geochronology on clay-rich fault gouge. Our  $^{40}\text{Ar}/^{39}\text{Ar}$  data confirm an Early Eocene activity of the thrust system. New geological cross-sections, including a balanced structural restoration of one segment, reveal pronounced partitioning of deformation between basement-involved thrusts (Lakora) and a shallow décollement atop post-rift Cretaceous limestones (Larra). In the western segment, intense folding and disharmonic deformation within Campanian–Maastrichtian turbidites absorb a large share of shortening to reconcile the full displacement budget observed in the root zone. In conclusion, the Lakora Thrust system exhibits diachronous and partitioned deformation, controlled by inherited transfer zones and stratigraphic décollements. Our findings not only constrain the timing of rift inversion and thrust propagation in the Early Eocene but also illuminate how structural segmentation and stratigraphic rheology govern the distribution of orogenic shortening in the Pyrenees.

**Mots-Clés:** Pyrenees, Lakora Thrust, Rift inversion,  $^{40}\text{Ar}/^{39}\text{Ar}$  geochronology, Fault gouge

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