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Fluvial incisions in the Western Pyrenees (Aspe valley): insights on the modes of dissection of a former planation surface

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The Pyrenean range results from the collision between the Iberian and Eurasian plates which started during the Santonian (e.g. Handy et al., 2010; Olivet, 1996; Rosenbaum et al., 2002). Iberia has shown no more relevant motion with respect to Europe since Early Miocene times (e.g. Srivastava et al., 1990; Macchiavelli et al., 2017). In this regard, the Pyrenees can no longer be considered as an active plate boundary from Miocene onwards. Previous studies on the post-shortening relief evolution of the Pyrenees have emphasized the existence of highly elevated – low relief planation surfaces (hereafter referred to as HELRS) all along the chain (see Bosch, 2016 for a complete review). Even though the origin of the HELRS is still strongly discussed, all authors agree that the HELRS are relicts of planation surfaces which were shaped during the post-shortening period. We identify remnants of these surfaces on top of the Aspe River flanks, thus questioning the modality and timing of the dissection of a former smooth topography in the North Western Pyrenees.
We recognize in the field and from Google Earth and Digital Elevation Model (DEM) data a complex landscape comprised of poorly preserved and stepped low relief relict surfaces associated with imbricated erosional triangular facets. Geomorphic attributes of the Aspe Valley flanks are extracted from a 5-m Digital Elevation Model (DEM; RGE ALTI® 5 m IGN) and used to characterize the entrenchment of the hydrographical network which led to the dissection of the Pyrenean planation surface. We attempt to reconstitute the landscape prior to the well preserved last incision episode in order to quantify the subsequent erosion. This incision attained more than 600 m in the most internal portion of the valley. Our aim is to link the observed progressive incision to foreland deposits. We then discuss the timing and processes able to cause this high amount of localized erosion. The combination of a Late Miocene humidification of the climate as well as Late Miocene to present-day relative uplifts evidenced in the Pyrenees by various authors account for the dissection of the Pyrenean planation surface.

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