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# Geomorphic characteristics of the Lannemezan megafan: an insight in the Late-Cenozoic evolution of the northern Pyrenean foreland (France)

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Large alluvial fans, either active or incised, characterize the orogen – foreland-basin transition in nearly all mountain belts worldwide. Understanding the evolution of fossil foreland alluvial fans and the incision history of their elevated paleo-surfaces can provide critical information on their past and present evolution and to distinguish between climatic and tectonic forcing. The most striking morpho-sedimentary feature of the northern Pyrenean foreland (SW France) is the Miocene Lannemezan megafan, but little is known about its evolution: what controlled the development of this fan and how is this related to the orogenic growth? When and why was the fan abandoned and incised? How large was the feature when it was active? We combine a quantitative morphometric analysis with field observations, low-temperature thermochronometry and cosmogenic dating to address these questions. The Lannemezan fan is exceptionally large ($10^4 km^2$), especially when compared to the other fans of the northern Pyrenean foreland and the fan area/catchment area ratio is anomalous. Calculations of the eroded vs. deposited volumes corroborate this unbalanced budget. The Neste River, which most likely used to feed the megafan, now bends 90° eastwards near the apex of the fan, indicating it was captured by the larger Garonne River in Quaternary times. The material forming the fan and the strath terrace system incising the fan, show a rather unusual sedimentological pattern for an alluvial fan setting, characterized by a very fine clay and sand matrix supporting sporadic pebbles and boulders (up to 50 cm in diameter). We show that the terrace slope increases with time and the current rivers exhibit markedly concave long profiles (reference concavity = 0.7), which could indicate late tilting of the fan. New cosmogenic nuclide analysis ($^{10}Be$,$^{26}Al$) will be used to date the abandonment of the fan surface and the terrace staircase chronology to provide constraints on incision rates and mechanisms (in terms of climatic change and/or tectonic deformation). The Neogene source-area exhumation rate and amount of post-orogenic unroofing will be investigated through the analysis of new detrital and in-situ apatite fission-track and (U-Th)/He analyses.