From orogenic building to post-orogenic dismantling: Insights from Low-Temperature Thermochronology in the Eastern Pyrenees

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Résumé

Several Alpine orogens show a tectonic evolution from orogenic building to post-orogenic dismantling. For the Eastern Pyrenees, this transition from compression to extension remains debated. Since the Oligocene, crustal extension linked to the opening of the Gulf of Lion overprinted the eastern Pyrenean belt, while compressional tectonics persisted in the central segment. This study applies low-temperature thermochronology to basement rocks in the Eastern Pyrenees to better constrain the timing and spatial distribution of the transition from shortening to extension. We present new (U-Th)/He cooling ages and thermal history models from the Axial Zone, supported by lag time analysis between zircon and apatite ages. These data allow us to distinguish tectonic units and reconstruct their cooling histories. Results indicate a major cooling phase during the early Oligocene (35–28 Ma), interpreted as the final compressional episode. Extension-driven exhumation began in the early Miocene (24–18 Ma), initially affecting the footwall of the reactivated Tec fault, which propagated south-westward during the late Miocene (11–5 Ma). Our findings suggest that the transition from compression to extension in the Eastern Pyrenees occurred between 28 and 24 Ma, during a period of relative tectonic quiescence.

Mots-Clés: Mountain building, orogen dismantling, thermochronology, Eastern Pyrenees

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