Tectonic activity of the Spanish Central System during Paleogene evidenced by structural and sedimentary geology, and apatite fission track analysis

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The tectonic evolution of central Iberia between a Mesozoic rift event (forming the Iberian Basin to the east) and the M. Miocene major intraplate deformation (related to the collision of Africa and Iberia/Eurasia), is poorly known. The development of the Spanish Central System (SCS) has been explained as related to the latter, but its tectonic activity prior to this compressional event has not been described. Outcrops of Paleogene sediments are found along the Southern Border Fault (SBF) of the SCS. The alluvial fans of Eocene to Upper Oligocene contain clasts of gneisses that are restricted to the SCS only. Seismic lines and drilling in the Madrid Basin (MB) which borders the SCS to the south, show Paleogene sediment thicknesses of up to 1400m. This indicates clearly that at least the north-eastern part of the SCS has been eroded during Paleogene and, therefore, must have been significantly active before M. Miocene.
To quantify this tectonic activity, we conducted a combined structural and sedimentological study of the Paleogene alluvial fans and their basement. Additionally, apatite fission track samples were taken to provide independent data on vertical motions and the timing of the major uplift. Paleostress data provide a tectonic framework and document the stresses transmitted from the plate boundaries active during the several stages of the development of the SCS. Within these stress fields, the multiple reactivation of deep-seated Late Hercynian basement faults has to be explained. Sedimentary logging of the fans constrained type of sedimentation, enabled determination of important unconformities and synsedimentary deformation. Linking all this data enables us to propose a new model for the Paleogene- Miocene evolution of the SCS:
**Eocene (~45Ma)* Large scale uplift of at least the NE SCS, being eroded and sedimentated into the Madrid Basin as large conglomerate (proximal) and silt/clay (distal) sheets. First deformation of the Mesozoic/Lower Paleogene cover under NNW-SSE compression, related to start of convergence between Eurasia and Iberia due to opening of the North-Atlantic.
**M. Oligocene (~30Ma)* The NNE-SSW compression, caused by collision of Eurasia and Iberia along the NE of the Iberian plate, leads to strike slip motion along the SBF, leading to en-echelon folding of the thin Mesozoic cover. This creates local relief in which local basins are being filled with isolated conglomerate bodies.
**M. Miocene (~12Ma)* Major differential uplift (1000-5000m) of the SCS. The inherited flower-type faults are accomodating the strain by popping-up under NNW-SSE compression. The activity along the SBF is shifted basinward by activating a new thrust, the by strike-slip deformation complicated structure of the former SBF can not be reactivated.