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Long-term evolution of the landscape at a coastal mountain range: the western Cantabrian Mountains (N Spain)

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The Cantabrian Mountains in northern Spain form a linear costal range with maximum elevations of 2700 m. They are considered to be the Alpine-age western prolongation of the Pyrenean Range that formed due to compression along the northern part of the Iberian plate during the Cenozoic. Iniciation of subduction at the margin has been dated as Eocene, and a similar age corresponds to the oldest sytectonic deposits over the foreland basin.

The topography of the western Cantabrian Mountains is formed by deformed Paleozoic age bedrock, and includes components that record a very long-term evolution of the landscape. These components include paleohorizontal markers, such as elevated surfaces of low relief and a raised marine wave-cut platform, that are preserved between the deeply incised fluvial system. We use digital elevation models (DEMs) in a 150 km long section of the mountains to identify the main components of the landscape and also to map their distribution and structure. The elevated surfaces of low relief at mountain submits appear between elevations of 500 to 1000 m, lowering towards the west. They are interpreted to correspond to relicts of a single, ancient peneplain displaced by faults that reactivate existing structures within the bedrock. Measured displacements reach up to 300 m. A regional thermochronological study provided preliminary ages that range from Early Triassic to Paleocene, concordant with very low values of denudation since iniciation of tectonic shortening. The raised marine platform reaches more than 3 km in width and appears above sea cliffs that are lower towards the west. A detailed DEM allows us to map the shoreline angle,

which rises eastward along the coastline from 100 to 220 m. This change in elevation occurs in several discrete steps interpreted to correspond to traverse faults with tens of meters of vertical displacement. Surface exposure dating that combined three different cosmogenic nuclides indicates that the marine platform emerged more than 1 Ma ago.

Our data indicates that the present landscape of the western Cantabrian Mountains may register an evolution history spanning several tens of million of years with long-term preservation of topographic components. The area may represent a good example of the landscape corresponding to initial stages of mountain growth next to a margin that underwent incipient, slow convergence.