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Cofinanciado por:



## Iberia, a natural laboratory for the quantification of the large scale erosional response to the fluvial capture processes

### *Iberia, um laboratório natural para a quantificação da resposta erosiva em larga escala aos processos de captura fluvial*

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**Key-words:** Duero, Ebro, Tajo, Denudation, Fluvial dissection, Cenozoic Basin.  
**Palavras-chave:** Duero, Ebro, Tejo, Denudação, dissecação fluvial, bacia cenozoica.

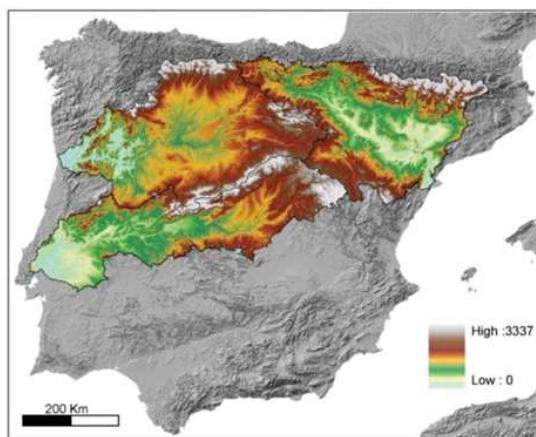
### ABSTRACT

Due to its geological location and diversity, Iberia is a key natural laboratory for the study of tectonic and geological processes. Within those it is especially suitable for the study of large-scale fluvial capture processes, and their influence on topography and landscape evolution.

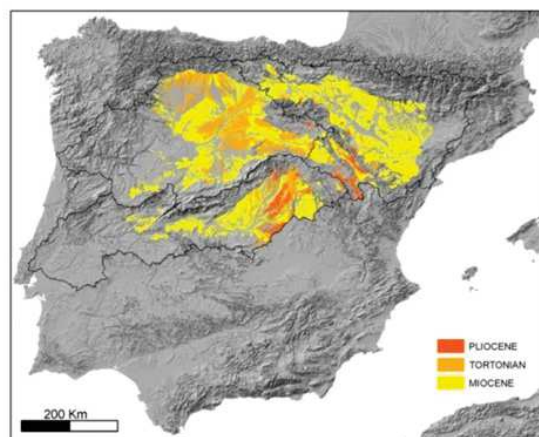
With an average elevation above 600 m, Iberia is one of

the highest regions in Europe and its peculiar topographic is the result of the interplay of tectonic and erosional processes, whose relative importance changed over times (De Vicente et al., 2011; De Vicente and Vegas, 2009; Fernandez-Lozano et al., 2009). Nowadays, Iberia is characterized by the presence of highly elevated extensive flat surfaces (Iberian Mesetas). Those high plains correspond to planation surfaces developed mainly on Palaeozoic and Mesozoic rocks, and sedimentation surfaces of Neogene rocks. These last mostly represent the sedimentary deposits related to infill of the, formerly closed, large Cenozoic Foreland Basins. Three main rivers (Duero, Ebro and Tajo) which watersheds cover an area over 250 km<sup>2</sup>, drain almost half of the total Iberia surface. For these basins the development of the present-day drainage network was related to the opening of formerly closed fluvial systems, developed within ancient Cenozoic basins.

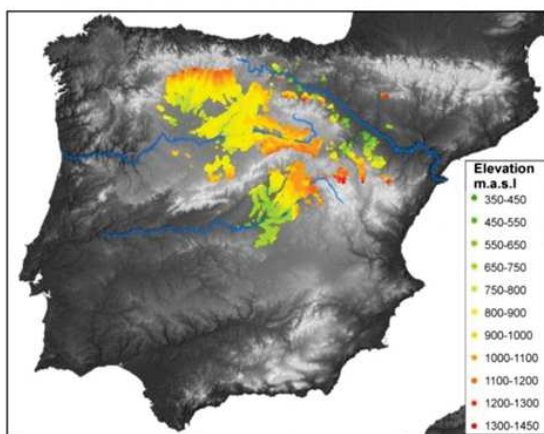
The opening of an outward drainage system involves the lowering of base level which is transmitted upstream along fluvial channels in the form of erosional waves, leading to high incision and denudation rates, within intrabasin areas. In Iberia, the signature of that change in drainage conditions is still preserved in some areas, and can be studied through the analysis of longitudinal profiles shapes (Antón et al., 2014; Antón et al., 2012; Ferreira et al., 2010; Martins et al., 2017), and the relief characterization. The analysis of present and former topography represents a powerful qualitative tool for a relative quantification of fluvial dissection and basin denudation, allowing to illustrate the spatial distribution of surface erosion, associated to the exorheic history of the basins (Anton and Munoz Martin, 2007). This work approaches the analysis of the denudation processes for the main Iberian basins, through the reconstruction of the Late Miocene sedimentary infill (Antón et al., 2016).



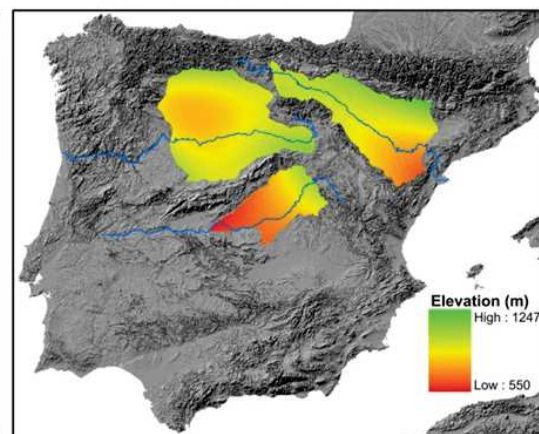
DEM OF THE DUERO, EBRO AND TAJO WATERSHEDS



NEOGENE DEPOSITS IN THE BASINS



ELEVATION OF PRESERVED TORTONIAN DEPOSITS



LATE MIOCENE PALEOSURFACES RECONSTRUCTION

## METHODOLOGY

By means of geological mapping, geostatistical tools, GIS and DEM we performed the reconstruction of the late Miocene's paleo-relief in the three main Cenozoic basins. The method consists in the reconstruction of the paleosurface (topography) characteristic of the last stages of the basins in-fill. For that we use geological data from the Spanish Geological Survey (IGME), selecting the preserved representative formations for the purpose (Tortonian sedimentary units). Using preserved relict surfaces, the reconstruction of former topography was approached through the generation of regional trend surfaces. By comparing the present and former topography along the basin, fluvial dissection and denudation patterns can be obtained, and a minimum volume of sediments eroded since the start of the exorheism can be estimated.

## RESULTS AND CONCLUSIONS

The application of the proposed methodology provides a quantification of the sediment fluxes in response to the drainage opening, and allows the construction of denudation maps for each basin. In the Ebro basin, the results reveal an eroded volume almost one order of magnitude higher than in the Duero and the Madrid (Tajo) basins, and a surface lowering several folds higher. The integrated analysis of erosional volumes and spatial distribution of dissection can be tackled in terms of timing, tectonic influences and the fluvial response to drainage captures. Although, key questions on the timing and processes involved in the shift of Iberia main drainage systems remain open, the study highlights important questions about the different response of the studied catchments. Results may help to understand the processes and timings involved in the Iberia's topographic and drainage evolution.

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