CLUES OF RECENT TECTONIC ACTIVITY ALONG THE UBIERNA FAULT SYSTEM (NORTHERN SPAIN)

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The Ubierna-Ventaniella fault system of northern Spain is ~ 300 km long NW-SE-striking strike-slip fault system. It is made by two segments, i.e. the Ubierna and Ventaniella faults, and crosses the entire Cantabrian Mts. (Tavani *et al*., 2011; López-Fernández *et al*., 2018) (Fig. 1a), from the Bay of Biscay to the NW to the Duero Basin to the SE. This lithospheric fault system displays a right-lateral offset along its entire length (e.g. Hernaiz, 1994; Alvarez-Marrón, 1995; Tavani *et al*., 2011), spanning from less than 4 km for the Ventaniella segment (Alvarez-Marrón, 1995) up to more than 10 km in the central portion of the Ubierna segment (Tavani *et al*., 2011). The Ubierna-Ventaniella fault system has been long time considered as almost inactive: the

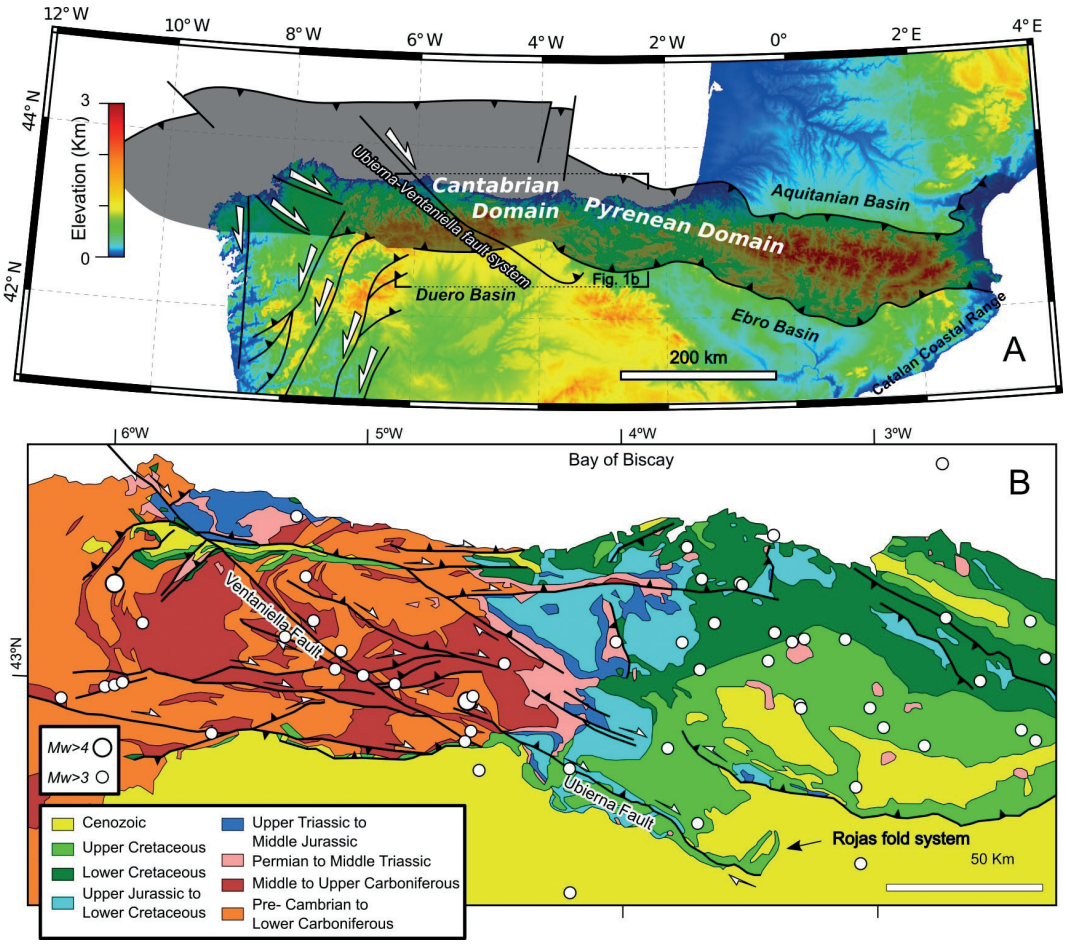

Fig. 1 - Geological framework of the study area. (A) Elevation map of the northern Iberian Peninsula with the main structural features. (B) Geological map of the Cantabrian Domain and western Pyrenean Domain, with Mw>3 earthquakes indicated.

instrumental seismic record of the area includes only some *Mw*>3 earthquakes, a few of them concentrated around the fault system (Fig. 1b), and the historical catalogue of the area is devoid of remarkable events too. Despite this, the Ubierna-Ventaniella Fault System is included in the Quaternary Active Fault Database of Iberia (García-Mayordomo *et al*., 2012), where it is quoted as "debated". Geological evidence of recent activity for this fault occurs indeed, including: (1) the Ventaniella fault offsets Lower Pleistocene alluvial fan and it is sealed by Upper Pleistocene deposits (Nozal Martín, F., Gracia Prieto, 1990); (2) a weak seismic activity is associated with the Ventaniella Fault (López-Fernández *et al*., 2018); (3) in its western portion, the Ubierna fault offsets and folds a Pliocene erosional surface (Gracia Prieto *et al*., 1990); (4) at the eastern contractional termination of the Ubierna Fault, i.e. at the Rojas fold system, geomorphic features that could be considered indicative of active folding occur (Tavani *et al*., 2011). In detail, tilted Lower to Middle Miocene strata unconformably overlying folded Upper Cretaceous carbonates occur along the Rojas fold system, together with fluvial captures, a tiled fluvial meander, and a tilted alluvial fan. All these structures suggest a late Miocene - or earlier - tectonic activity along a fault system offering rupture areas exceeding 10^3 km^2, hence having a remarkable seismogenic potential. In this work we analyse the structures indicative of a possible recent activity along the Rojas fold system, with the aim of better defining the timing

of folding and thus of strike-slip faulting. Publicly available high-resolution digital elevation models, 0.5 mt/px orthophotos, and 1:50.000 geological map have been combined to carry out a remote sensing analysis of the possible neotectonic features, which has been integrated with the study of long profiles of the streams crossing the folded structure and displaying fluvial captures. Our study provide evidence of fluvial meander and alluvial fan tilting during the late Miocene or earlier. Instead, the fluvial captures developed after the end of folding, in the framework of the regional capture of the tributaries of the Duero river by the Ebro River since the late Pliocene period. In agreement, we conclude that the Rojas fold system has started its last stage of folding at least during the Late Miocene but it is essentially inactive at least since the late Pliocene.

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