



Paleoseismological investigation in the Plio-Quaternary Munébrega Half-graben (Iberian Chain, NE Spain)

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The Iberian Chain, in the NE of Spain, is an intraplate Alpine orogen created by the tectonic inversion of Mesozoic basins (orogenic stage, late Cretaceous-early Neogene). In the central sector of the orogen, westward propagation of a rifting process gave rise to Mio-Pliocene grabens, and later Plio-Quaternary half-grabens locally superimposed on the western margins of the pre-existing grabens (postorogenic stage). The Munébrega Plio-Quaternary Half-graben is a 19 km long and up to 3 km wide NW-SE trending neotectonic depression superimposed on the western margin of the Calatayud Neogene Graben. The Munébrega basin has been recently captured, and its poorly exposed fill consists of more than 30 m of fine-grained and gravel sheet-flood alluvial fan facies capped by a petrocalcic horizon that displays the stage V of Machette's sequence. The NE margin of this fault-angle depression corresponds to a prominent horst structure flanked by the Munébrega E and Munébrega W normal faults. The Munébrega W Fault has controlled the development of the Munébrega depression, and has generated a well-defined mountain front with conspicuous triangular and trapezoidal fault facets. In the north-western sector of the half-graben, this master fault offsets an Upper Pleistocene mantled pediment creating a straight uphill-facing scarp. This pediment deposit grades distally into a 20 m thick terrace of the Jalón River whose aggradation surface is located at 45 m above the current channel.

A 40 m long backhoe trench has been dug perpendicularly to the 7.5 m high antisllope fault scarp of the Munébrega W Fault in order to conduct a paleoseismological investigation. This is the first trench ever dug across a Quaternary fault in the Iberian Chain for such a purpose. The sediments exposed in the trench walls show numerous deformational structures within a 25 m wide band, including fissure fills, cross-cut synthetic and antithetic normal faults, grabens, a roll-over, a monoclinical flexure, and

reverse faults that may correspond to oversteepened normal faults. The higher thickness of the alluvial sequence in the downthrown sector of this fault zone suggests that deposition has been controlled by the fault activity (syntectonic sedimentation). A cumulative vertical displacement of 7.5 m has been measured on the deformed mantled pediment deposit. Only minor earthquakes (with magnitude up to 3.5) have occurred in the vicinity of the Munébraga W Fault in the last 30 years. However, this investigation indicates that this fault could be potentially seismogenic. The mappable length of the structure (ca. 20 km) indicates that it might generate earthquakes with moment magnitudes as large as 6.9. The OSL ages of the sampled units will allow calculating the slip rate of the fault (probably ca. 0.2 mm/yr) and providing a rough estimate of the recurrence of large earthquakes on this fault.