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A new relevant seismic source of the Eastern Betic Shear Zone with Holocene activity: Los Tollos Fault (Murcia, SE Spain).

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The NW–SE convergence between the Nubian and Eurasian plates in the western Mediterranean (4–5mm/yr) produces a crustal deformation of the southeastern Iberian Peninsula where Late Neogene and Quaternary faulting activity is dominated by a large NE-SW left-lateral strike-slip fault system: the Eastern Betic Shear Zone (EBSZ). The EBSZ is a cortical structure in NNE to NE direction and sigmoid trace that stretches for more than 450 km, and includes, from north to south, the well-known faults of Bajo Segura, Carrascoy, Alhama de Murcia, Palomares and Carboneras.
Historically, several of the most destructive seismic events in the Iberian Peninsula, reaching intensities up to IX-X (MSK), have occurred in the area. Those events have been related to the main faults belonging to the EBSZ. Recently, one of the most damaging earthquakes recorded in recent times in Spain, the Lorca earthquake (11/05/2011, Mw 5.2. IEMS98 VII), has been related to the Alhama de Murcia Fault.

In this work, we present Los Tollos Fault (LTF) as a new relevant tectonic feature belonging to the Eastern Betic Shear Zone. LTF is located southwest of the Carrascoy Fault, close to densely populated villages (eg: Alhama de Murcia, Totana) and less than 30 km away from downtown Murcia, the largest city of the region with almost half a million inhabitants. This fact highlights the importance of studying the LTF seismogenic potential in order to gain a better picture of the local seismic hazard and risk in the region. The aim of this work is to contribute with new data to parameterize the paleoseismic activity of this active fault in order to be included in future seismic hazard assessments of the area.

LTF has been previously mapped as normal fault dipping to the NW. Furthermore, it has also been interpreted as the possible SW extension of the Carrascoy Fault. However, we show that LTF is actually a left-lateral reverse fault dipping to the SE and that it has no apparent connection to the Carrascoy Fault. Data analysis from 4 trenches dug across the fault has revealed the occurrence of at least four paleo-earhtquake events within the Holocene. The most recent event is dated in between 2350 and 2140 years BP (4th to 2nd centuries BC) at the end of the Carthaginian period or in the early Roman times in the region. The size of the paleo-events is estimated in more than Mw 6.2, consistently with empirical regressions both on the average displacement per event, and on the length of LTF. The recurrence interval between events is estimated in 2200-2445 years, which means that the fault may be close to produce a new major earthquake.