



## **Growth and interaction of active normal fault segments in the Umbria-Marche Apennines of Central Italy**

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In the upper, seismogenic crust, deformation occurs mainly by frictional sliding on pre-existing discontinuities generating earthquakes which magnitudes depend of the fault size. In this context, the understanding of the tectonic history and of interaction of fault segments can provide information on the maximum magnitude of a future earthquake. The recognition that the growth of fault segments is achieved by the accumulation of multiple seismic events, points the attention of research on Quaternary fault segments which record the recent tectonic history.

In this study, we present a reconstruction of the growth history of two major Quaternary fault zones in Northern Apennines, the Gubbio and Colfiorito normal fault zones. These fault zones strike NW-SE, dip towards SW, border Quaternary basins and are commonly considered active faults. Among widespread historical seismicity, these areas were recently struck by destructive earthquakes in 1984 ( $M_s=5.3$ ) and in 1997-98 ( $M_w=5.7$ ,  $M_w=6.0$ ) all occurred on normal faulting.

On the basis of our reconstruction of the long term displacement, the northernmost Gubbio fault is a 25 km long normal fault with maximum throw of about 2.2 km. However, our data indicate that a part ( $\sim 800$  m) of the throw was achieved before the Quaternary. The Colfiorito fault zone is more complex, being formed by four main fault segments with lengths 7-9.5 km and with maximum throws of 250-550 meters. The two central segments of Colfiorito are in en-echelon array and the throw distribution along the segments shows interaction, forming a greater 17 km long fault zone comparable with the Gubbio fault. Long-term slip-rates measured by displacement values and basins age provide values of 0.9 mm/yr for Gubbio and 0.37 mm/yr for Colfiorito providing rates of extension which can be compared and discussed with those provided by other data sources like geodetic strain seismic moment summation.