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Constraining fault activity by investigating tectonically-deformed Quaternary palaeoshorelines using a synchronous correlation method: the Capo D'Orlando Fault as a case study (NE Sicily, Italy)

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Long-term curstal extension rates, accommodated by active normal faults, can be constrained by investigating Late Quaternary vertical movements. Sequences of marine terraces tectonically deformed by active faults mark the interaction between tectonic activity, sea-level changes and active faulting throughout the Quaternary (e.g. Armijo et al., 1996, Giunta et al, 2011, Roberts et al., 2013). Crustal deformation can be calculated over multiple seismic cycles by mapping Quaternary tectonically-deformed palaeoshorelines, both in the hangingwall and footwall of active normal faults (Roberts et al., 2013).
Here we use a synchronous correlation method between palaeoshorelines elevations and the ages of sea-level highstands (see Roberts et al., 2013 for further details) which takes advantage of the facts that (i) sea-level highstands are not evenly-spaced in time, yet must correlate with palaeoshorelines that are commonly not evenly-spaced in elevation, and (ii) that older terraces may be destroyed and/or overprinted by younger highstands, so that the next higher or lower paleoshoreline does not necessarily correlate with the next older or younger sea-level highstand.
We investigated a flight of Late Quaternary marine terraces deformed by normal faulting as a result of the Capo D'Orlando Fault in NE Sicily (e.g. Giunta et al., 2011). This fault lies within the Calabrian Arc which has experienced damaging seismic events such as the 1908 Messina Straits earthquake $\sim$ Mw 7. Our mapping and previous mapping (Giunta et al. (2011) demonstrate that the elevations of marine terraces inner edges change along the strike the NE – SW oriented normal fault. This confirms active deformation on the Capo D'Orlando Fault, strongly suggesting that it should be added into the Database of Individual Seismogenic Sources (DISS, Basili et al., 2008). Giunta et al. (2011) suggested that uplift rates and hence faults lip-rates vary through time for this examples. We update the ages assigned to each palaeoshoreline from the initial work by Giunta et al., (2011) using synchronous correlation. This alternative approach suggests that uplift rates were constant through the Late Quaternary, suggesting that the fault slip-rate governing seismic hazard has also been constant.

Reference

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