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Paleoseismologic and geomorphic constraints to the deformation style and activity of the Cittanova Fault (southern Calabria, Italy)

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The western side of Southern Calabria is the epicentral region of the strongest earthquakes of Italy. These are mainly generated by extensional faults which are still poorly investigated and/or parameterized. In this study, we explore the potential of the combined analysis of geomorphic markers, stream network morphometry and paleosimological investigations, aimed at identifying and time-constraining the surface effects of the Calabrian seismogenic faults.

In this perspective, we presents results from i) plano-altimetric analysis of geomorphic markers related to active tectonics (such as marine and fluvial terraces), ii) paleoseismological investigations, and iii) time-dependent river basin and long-profile metrics of the Cittanova Fault (CF).

The CF, responsible for the catastrophic Mw 7.0 earthquake of 5 February 1783, is a N220° striking, 30 km-long normal fault that downthrows the crystalline-metamorphic basement of the Aspromonte massif ($\sim$1000 m asl) below the Gioia Tauro Plain, to elevations of $\sim$500–800 m bsl. Radiocarbon dating allowed us to ascribe the depostion of a major terraced alluvial fan (Cittanova-Taurianova terrace, TAC) to the early Last Glacial Maximum (LGM) and to date the avulsion of the depositional top surface of TAC to 28 ka. As we have found remnants of the TAC also in the CF footwall offset by 12-17 m, we estimate a vertical slip rate of 0.6 $\pm$ 0.1 mm/yr for the past 28 ka.

Paleoseismological data across the fault scarp evidenced at least three surface ruptures associated to $\sim$Mw 7.0 paleoearthquakes prior to the 1783 event. The recurrence time ($\sim$3.2 kyr) is rather longer than other Apennine normal faults (0.3–2.4 kyr), whereas it is consistent with the low slip rate of CF for the late Upper Pleistocene (0.6 mm/yr). On a longer time scale, the spatial configuration of river basin morphometry evidenced the morphodynamic rensponse to the higher slip in the central sector of CF. Furthermore, long-profile metrics, and in particular the spatial analysis of knickpoints within the footwalls, were performed to constrain the deformation style and the timing of faulting events producing surface perturbations.