

Geological/seismological data for the generation of a 3D fault model: the southeastern Sicily 1693 earthquake case study

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Our study focuses on the area of maximum damage of the 1693 main shocks (9 and 11 January, $M_w \approx 6.1$ and $M_w \approx 7.3$, respectively). Numerous secondary effects (liquefaction, landslides, fractures and ruptures), described by historical accounts, caused important landscape modifications in the eastern side of the Hyblean Plateau. However, given the absence of clear evidence of surface faulting and relevant faults in the area of maximum effects, several faults located nearby were associated to these earthquakes (see DISS Working Group, 2015 and references therein).

We performed a revision of the macroseismic data of the 1693 shocks and mapped in detail the seismogeological effects. The most numerous and relevant effects occurred in the sector embracing Palazzolo, Lentini and Catania, suggesting that the sources of the 1693 earthquakes are located in this area. The 11 January earthquake is located northward, probably offshore, due to the following tsunami generation.

To observe the recent activity of faults crossing the area, we performed: a detailed fault mapping, through DTM and aerial photos analyses and geological-structural surveys; a geomorphologic analysis and the morphometric study of four rivers flowing in the area. We mapped NE-SW and NW-SE faults and a NNE-SSW major fault system (PBFS), running for about 30 km, from Palazzolo up to Brucoli and probably extending offshore. Geomorphological and morphometric analyses highlight recent tectonic activity associated to some of the mapped faults, with specific reference to the NE-SW system and PBFS.

To constrain the geometry and kinematics of the detected faults, we analyzed instrumental seismicity: about 1500 earthquakes with $0.4 \leq M \leq 4.6$, recorded during 1994-2017 by the Istituto Nazionale di Geofisica e Vulcanologia. Shocks are mainly characterized by strike slip or transtensive mechanisms (Musumeci et al., 2014) and a low-to-moderate energy release at depth 10-25 km. Most of the earthquakes are located offshore in the Ionian Sea between Catania and Siracusa, on land in the Augusta area, in the Palazzolo - Canicattini area and across the Avanfossa Gela-Catania. Seismicity distribution depicts two main clusters along a N-S direction overlapping the area affected by most seismogeological effects and nearby the NNE-SSW PBFS is mapped.

A 3D fault model of the likely structures involved in the sequence is constrained by an integrated structural-kinematic-seismological approach.

DISS Working Group (2015): Database of Individual Seismogenic Sources (DISS), Version 3.2.0: A compilation of potential sources for earthquakes larger than $M 5.5$ in Italy and surrounding areas. <http://diss.rm.ingv.it/diss/>, INGV: DOI:10.6092/INGV.IT-DISS3.2.0.

Musumeci, C., Scarfi, L., Palano, M. & Patané, D. (2014): Foreland segmentation along an active convergent margin: new constraints in southeastern Sicily (Italy) from seismic and geodetic observations. *Tectonophysics*: <http://dx.doi.org/10.1016/j.tecto.2014.05.017>.