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Multidisciplinary approach to detect the seismogenic source of the Tortona 1828 earthquake.

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The seismic potential of the Piemonte Region is commonly associated with two main seismic districts: Northern Cottian Alps and Borbera-Grue (North-Western Apennines). This potential appears to be underestimated due i) to the lack of details in the available historical catalogs and ii) to the almost complete absence of information concerning the seismogenic sources responsible for the main events occurred in the two areas: the 1808 Pinerolo (Mw 5.64, Io VIII) and the Tortona 1828 (Mw 5.72, Io VIII) earthquakes. In particular, the Tortona 1828 earthquake caused several casualties and significant diffused damages. In order to obtain a more precise evaluation of the seismic potential in the area, we performed a revised collection of published and unpublished historical documentation. The processing of the collected data allowed to calculate the seismic effects on the urban and natural landscape and the consequent revision and updating of macroseismic catalogs. Moreover the evaluation of seismic intensity at the municipal and sub-municipal scale highlighted anomalies in the damages distribution due to "site effects". Starting from a morphometric analysis we detected some areas characterized by strong anomalous relief energy and sharp deviation of the river pattern. Field surveys allowed to verify the presence of tectonic, as well as lithological, influence on the drainage network distribution. In this way a sector crossing the Staffora River has been judged anomalous and we performed detailed geological, geomorphological and geophysical surveys to detect if Quaternary successions show presence of brittle deformations. The geophysical analysis revealed the possible presence of a fault surface affecting an alluvial deposit, Late Pleistocene in age. The analysis of the local microseismicity of the last 35 years shows a low frequency seismic activity in the area, concentrated within 20 km of depth, with the greatest energy released in the most shallow layers. Using Matlab we perform a Direct Linear Transformation (DLT) in order to estimate the plane that best fits the selected hypocenters; then plane orientation, expressed in terms of dip and dip direction, is calculated following the equations proposed by Ferrero et al. (2009). The results show a general presence of high angle surfaces east-west oriented, suggesting a possible expression of the Avolasca-Musigliano Fault (Festa et al., 2014).

Key words: historical investigation, geomorphological survey, geophysics, modelling.