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Surface faulting and liquefaction hazard assessment in the central Apennines for land use practices: a case study from the L'Aquila urban area (central Italy)

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The Seismic Microzonation, as practiced in Italy, consists in defining microzones of the territory affected by homogeneous response to seismic ground shaking, defined as stable zones, vulnerable seismic amplification zones, and unstable zones. In detail, the unstable zones are affected by landslides, soil liquefaction, ground subsidence and surface faulting. In this framework, we conducted a study in the administrative district of L'Aquila (central Italy) aimed at the construction of a new school building, in an area indicated as prone to surface faulting (an active and capable fault was hypothesised in the area) and liquefaction.

We dug two trenches (named as A and B) perpendicular to the presumed active fault trace. The excavation walls exposed several different continental units mainly characterized by colluvial, organic-rich and "cultural" sediments, as well as paleosols. In trench A, some units, made of sandy-gravelly colluvial deposits, contained abundant pottery fragments, being intensely reworked by very recent human activity. These units were mainly composed of silt and sand sparse with carbonate clasts and directly overlying Middle Pleistocene alluvial deposits. Trench B only exposed units containing pottery fragments and hence pertaining to historical times. Several radiocarbon dating made on charcoal found within these units confirmed the recent age of the deposits, spanning from 25000 to 1800 years before the present. The analysis of the trench walls, the analysis of two boreholes, and field geological investigations revealed the absence of any surface faulting events affecting the stratigraphic sequence of the area, at least since the Middle Pleistocene, likely since the Early Pleistocene. Furthermore, trench B exposed several sedimentary dikes reaching up close to the ground surface, crossing the historical colluvial units, as well as other deformation features typical of liquefaction phenomena. The radiocarbon age determination and the sedimentological characteristics of the units indicate that the most recent liquefaction event occurred after 180 A.D.

Ultimately, this work represents a “best-practice” case study to investigate the occurrence of geological surface criticalities (such as surface faulting and liquefaction) at specific sites of interest.