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Evidence of Quaternary rock avalanches in the central Apennines: new data and interpretation of the huge clastic deposit of the L'Aquila basin (central Apennines, Italy)

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Active extensional tectonics and widespread seismicity affect the axial zone of the central Apennines (Italy) and led to the formation of several plio-quaternary intermontane basins, whose morpho-evolution was controlled by the coupling of tectonic and climatic inputs. Common features of the Apennines intermontane basins as well as their general morpho-evolution are known. Nonetheless, the complex interaction among regional uplift, local fault displacements and morpho-climatic factors caused differences in the denudational processes of the single intermontane basins. Such a dynamic response left precious records in the landscape, which in some cases testify for the occurrence of huge, catastrophic rock slope failures. Several Quaternary rock avalanches have been identified in central Apennines, which are often associated with Deep Seated Gravitational Slope Deformation (DSGSD) and thus strictly related to the geological-structural setting as well as to the Quaternary morpho-structural evolution of the mountain chain.

The L'Aquila basin is one of the intermontane tectonic depression aligned along the Middle Aterno River Valley and was the scene of strong historical earthquakes, among which the last destructive event occurred on April 6, 2009 (Mw 6.3).

We present here the evidence that the huge clastic deposit on which the city of L'Aquila was built up is the body of a rock avalanche detached from the southern slope of the Gran Sasso Range. The clastic deposit elongates for 13 km to the SW, from the Assergi Plain to L'Aquila and is characterized by typical morphological features such as hummocky topography, compressional ridges and run-up on the opposite slope. Sedimentological characters of the deposit and grain size analyses on the matrix let us confirm the genetic interpretation, while borehole data and significant cross sections allowed us reconstructing the 3D shape and volume of the clastic body. Finally, morphometric analyses of the Gran Sasso Range southern slope evidenced the possible source area of the inferred rock avalanche, which is framed within a slope section characterized by the presence of DSGSD-related landforms. The estimated volume of this source area is coherent with the volume calculated for the outcropping landslide body, both in the order of magnitude of hundreds of millions of cubic meters.

Such a study is framed within a wider research activity addressed to a better understanding of the role of gravity-induced processes in the Quaternary morpho-evolution of the Apennine chain, but also to assess the potential "residual risk" conditions affecting the slopes already involved in DSGSD and massive rock slope failure processes.