

The Sasso Pizzuto landslide dam and seismically induced rockfalls along the Nera River gorge (Central Italy).

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The seismically induced landslides are among the most destructive and dangerous effects of an earthquake. In the Italian contest, this is also documented by a national catalogue that collects data related to earthquake-induced ground failures in the last millennium (CEDIT database). In particular, Central Italy has been affected by several historical landslides triggered by significant earthquakes, the last of which occurred in August-October 2016, representing the Italian strongest event after the 1980 Irpinia earthquake (Mw 6.9).

The study presents the effects of recent seismically induced rockfalls occurred within the Central Italy seismic sequence (October 30, 2016) along the Nera River gorge between Umbria and Marche. The study area is completely included in the Monti Sibillini National Park, where the highest mountain chain in the Umbrian-Marchean Apennine is located. Most of rockfalls have affected the “Maiolica” formation, a stratified and fractured pelagic limestone dating to the Early Cretaceous.

The seismic sequence produced diffuse instabilities along the SP 209 road within the Nera River gorge: boulders, debris accumulations and diffuse rockfalls have been mapped. Most of boulders have size ranging from 0.3 to 2.0 m in diameter. Although several strong quakes (Mw > 5) occurred during the August-October sequence, only the main quake triggered the Sasso Pizzuto rockfall producing a landslide dam along the Nera River.

The landslide appears to have originated as a wedge failure, which evolved to free fall when the rock block lost the contact with the stable rock mass. In other words, the quake produced the “explosion” of the rock wall allowing the rockfall process. Once the rock mass reached the toe of the slope, it was broken triggering a rock avalanche that obstructed both the Nera River and SP 209 road.

With the aim to estimate the total volume of involved rock, a field survey was carried out by using a laser rangefinder. Remote measures were acquired taking into account the inclination, horizontal, vertical and slope distance. Through topographical calculations and GIS analysis, it has been possible to reconstruct the size and shape of debris accumulation estimating a volume of about 70000 m³ (± 8000 m³ due to measurements accuracy). This agrees with qualitative measures independently performed. The maximum distance between the debris accumulation and rockfall source area is about 200 m; the altitude difference is 270 m. The landslide debris partially dammed the Nera River, generating a lake upstream: currently the stream is flowing on the road among debris.