Geophysical Research Abstracts
Vol. 15, EGU2013-11127, 2013
EGU General Assembly 2013


# Mechanics of rockslides in a layered marly-arenaceous formation

Alessandro Simoni (1), Matteo Berti (1), Anna Rita Bernardi (2), Monica Guida (2), Franco Ghiselli (2), Marco Pizziolo (2), and Domenico Preti (2)

(1) Università di Bologna, Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Bologna, Italy, (2) Regione Emilia-Romagna, Bologna, Italy

In April 2005, following intense rainfall, three spectacular rockslides occurred in the eastern sector of the Northern Apennines of Italy. The landslides affected a flysch formation characterized by rhythmic alternations of sandstone and fine grained (pelitic) layers, locally known as “Marnoso-Arenacea” formation. The rock blocks detached along gently-sloping bedding planes (8° to 12° degrees) and slid downhill exhibiting varied amount of internal deformation. The thickness of the rock slabs ranged from 15 to 30 m and the overall volume from 1E5 to 1E6 cubic meters. An eyewitness interviewed during field work said that one of the three events (the Pezzolo landslide) produced a loud crashing sound associated to shaking of the ground. According to his description the rockslide moved with a peak velocity of 1-2 m/s.

Geomorphic evidences of ancient rockslides are common in the Marnoso-Arenacea Formation. Most of the slopes where beddings dip similar to the slope are characterized by scarps, structural surfaces, debris deposits, and detached rock blocks clearly associated to past rockslides. The temporal frequency of these landslides is relatively low. Multiple catastrophic rockslide events occurred only once in the previous 70 years (May 1939) and, also in that case, a limited number of failures was triggered. Despite their low frequency, the risk associated to these phenomena is significant because of the high speed associated to the large volume and to the widespread presence of vulnerable elements.

After the 2005 events a three-years research project was started in order to improve our knowledge on these particular landslides. On one side, detailed geomorphological surveys, geotechnical laboratory tests, and parametric back-analyses were performed on rockslides to evaluate the hydraulic conditions that triggered the failures. On the other side, four potentially unstable slopes were identified and instrumented by means of automatic pressure transducers and inclinometers, in order to investigate the hydrologic behavior of the slopes.

The results indicate that the shear surfaces are essentially planar and mostly develops along pelitic layers. Such layers exhibit substantial homogeneity (grain-size and plasticity) throughout the succession and possess residual strength close to 20°. Notable deformation occurs before failure in association to the opening of tension cracks along the crown that favors the infiltration of surface water. Piezometric heads at depth show strong seasonal influence with peaks occurring only in the late wet season when connection between precipitations and piezometric responses becomes more evident. Heavy rainfalls are then capable to rapidly increase the pore water pressures that can eventually exceed the hydrostatic values. The observed hydrologic behavior can be produced by flow through a network of fractures and is likely to play a key role in triggering the blockslides. Back analysis results support such interpretation indicating that pressures in excess of hydrostatic are required to reach failure conditions.