Earthflows and their mechanisms

Earthflows represent peculiar slope movements, explicitly considered in all proposals of landslide classification, which typically involve indurated fine-grained soils (stiff clays, clay shales and marls). However, they are variously named (earth-flows, mud-slides, mud-flows) depending on the consolidated local use. The expression earth-flow owns to the American use; mud-slide is the corresponding British term. In Italian we use the expression *colata di argilla*, but when we write in English we have to choose the most appropriate term, and this is not an easy problem for non-native speakers. However that is not our problem.

In the early 2000s, John Hutchinson convinced me to adopt the name mud-slide which has the merit to outline at the same time the double ambiguous style of these peculiar soil bodies which typically slide while flowing. As a matter of fact, some papers I wrote at that time concerned the behaviour of mud-slides. More recently, Oldrich Hungr and Serge Leroueil forced me to use the term earth-flow, but even though moved by their certainties and mastery of the language, I kindly asked to unify the separate words earth and flow into the unique word earthflow in order to at least hide the isolated and incongruous term "earth" that had been cancelled from our own update of the Varnes classification [Hungr *et al.*, 2014]. That was the only way to reconcile my opinion with their stronger one (the one of two robust guys against one only!).

Earthflows are widespread in many parts of the world, mostly in areas occupied by stiff highly fissured clays and clay shales [Hutchinson *et al.*, 1974; D'Elia, 1975; Bovis, 1985; Pellegrino *et al.*, 2005]. The contrast between the basic soil stiffness and the nature of the movement that takes place as the soil starts moving dowsnslope is always a surprise. However, the real landslide mechanism is more complex than the one manifested at the ground surface, since a shear zone and some ephemeral slip surfaces are always present at the base of the soil mass [Cruden, 1993]. Moreover, there are moments in which this seems to flow and moments in which it clearly slides. Soil deterioration and pore water regime seem to play a key role in the mechanics of the movement.

The stimulating theme of earthflow mechanisms was proposed to the participants in a special session of the Mediterranean Workshop on Landslides (MWL) organised in Naples in 2013. Some of them accepted to publish their contributions in the «Rivista Italiana di Geotecnica» These articles are now available in the special issue we present here, which includes the following papers:

- M. Berti, A. Simoni, *Groundwater and ground displacement monitoring in the source area of the Montecchi earthflow (Northern Apennines, Italy);*
- M. Maček, B. Majes, A. Petkovšek, *Lesson learned from 6 years of suction monitoring of the Slano Blato landslide;*
- G. Belokas, G. Dounias, *The Tsakona landslide in the Peloponnese – Greece;*
- S. Cola, F. Gabrieli, G. Marcato, A. Pasuto, P. Simonini, *Evolutionary behaviour of the Tessina landslide;*
- G. Urciuoli, L. Comegna, C. Di Maio, L. Picarelli, *The Basento Valley: a natural laboratory to understand the mechanics of earthflows.*

The first two contributions deal with some special and often disregarded aspects of the pore pressure regime in earthflow bodies, looking in particular at the mechanisms of infiltration into the shallowest layers. In the dry seasons these are fissured, possibly unsaturated, in any case subjected to high suction that disappear when the weather conditions change. The conditions of infiltration into the deepest layers and the mechanical response of the soil mass (displacement field and style) are affected by these phenomena which govern the landslide behaviour. Both

articles are based on field data obtained from the monitoring of two earthflows respectively located in the Northern Apennines, in Italy, and in Slovenia.

The further three papers look at the boundary value problem of the earthflow triggering and evolution. The first one describes a large landslide in Greece characterised by peculiar features and movement style, which involved a long bridge posing serious problems to its construction and following exercise. The paper by COLA *et al.* describes the well-know Tessina earthflow, which threatens an inhabited zone in the Alpine area of Northern Italy, reporting the data obtained through a monitoring system including also automatic readings. The relationship between pore pressures and displacement rate is discussed, stressing the fundamental role of the pore pressure regime on the landslide behaviour and indirectly the landslide hazard. Finally, the paper by URCIUOLI *et al.* employs the data collected by the monitoring of five large earthflows in highly tectonized clay shales outcropping in the Basento valley, Southern Apennines, to depict a consistent framework about the mechanisms and temporal evolution of this type of movement that is so widespread in such formations.

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