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Landslides in hard soils and weak rocks

People living in the Mediterranean area share a common history marked not only by bloody wars and continuous struggles but also by a parallel and mutually influencing production of artefacts and ideas and by a (sometimes unconscious) common worldview. The Mediterranean area presents also similar geological contexts and geo-hydrological hazards, for which solutions require remarkable human and technological resources. For example, active seismicity and a widespread susceptibility to landsliding are relevant problems for many countries.

Awareness of these and other common problems should be a trigger for neighbouring countries to establish closer relationships and a steady exchange of ideas. This simple consideration, which is not always clear in the minds of people and their leaders, should be the engine for the development of common initiatives and strategies.

Quite recently, the geo-engineering community has paid attention to the special features of hard soils and weak rocks (HSWRs) which are widespread in this corner of the world. In 1993, the Hellenic Society of Soil Mechanics and Foundation Engineering and the French Committee for Soil Mechanics and Foundation Engineering jointly organized an international symposium in Athens on "The Geotechnical Engineering of Hard Soils and Soft Rocks" (A. Anastagnopoulos, F. Schlosser, N. Kalteziotis, and R. Frank eds.). Five years later (1998), the Italian Geotechnical Society accepted the baton and organized the Second International Symposium on "The Geotechnics of Hard Soils and Soft Rocks" in Naples (A. Evangelista and L. Picarelli eds.). More recently, Greek colleagues from Athens hosted the 15th European Conference of Soil Mechanics and Geotechnical Engineering (2011), once again devoted to "The Geotechnics of Hard Soils and Weak Rocks" (A. Anastagnopoulos, M. Pachakis, C. Tsatsanifos eds.).

HSWRs pose continuous and complex problems to the stability of natural slopes, excavations, tunnels, and other works. However, the behaviour of HSWRs cannot be simply interpreted through the basic laws of Soil or Rock Mechanics, since they lie at the boundary between these two wide families of geomaterials, and have distinct features. On the other hand, it is in this grey zone that many conceptual problems emerge and this is where energy and effort should be spent.

With such considerations, the Seconda Università di Napoli, the Università di Napoli Federico II, and the Universitat Politechnica de Catalunya jointly organized a Mediterranean Workshop on Landslides (MWL) entitled "Landslides in Hard Soils and Weak Rocks – An Open Problem for Mediterranean Countries" in Napoli in October, 2013. The workshop included two sessions. Some papers presented in the first session "Landslides in Hard Soils and Weak Rocks and Relevant Material Properties" have been collected in a special issue that is a part of this journal. The papers are briefly presented as follows.

The first, by Corominas et al., examines the classification of clayey rocks, whose durability is still a relevant topic although much discussed by prominent researchers in the 1970s and the 1980s. In particular, Corominas et al. examine the role of texture in the long-term durability of clayey rocks.

Based on their experience with materials outcropping in the Iberian Peninsula, Alonso and Pinyol discuss aspects of the peculiar behaviour of claystones, focusing on the role of brittleness, discontinuities, and weathering. Some case histories provide interesting data with special reference to the strength of such not-easy-to-study materials.

The paper by Di Maio et al. discusses the residual strength of highly fissured marine clay shales with special reference to pore-fluid influence due to infiltration of fresh water. Di Maio et al. examine also the mechanisms of creep along shear surfaces that appears to govern the movement of a slow earthflow.

The other papers provide a variety of case studies of landslides in HSWRs.

Oliveira et al. examine the reliability of persistent scatterer synthetic aperture radar interferometry to identify and map landslides, to update their state of activity, and to possibly assess susceptibility to landsliding. An in-depth investigation is described concerning the Grande da Pipa River basin, North of Lisbon, that is underlain by marls, stiff clays, and sandstones with clayey intercalations.

Abolmasov et al. describe the paradigmatic Umka landslide in Neogene marls, one of the many landslides (with similar features) along the banks of the rivers Sava and Danube in Serbia. The influence of weathering, precipitation, and snowmelt on landslide triggering and behaviour is examined, and a general framework is proposed about similar slope movements in the area.

Cotecchia et al. describe three slow landslides in turbiditic soils, stressing the role of fissuring on soil permeability and strength, and thus on the general slope behaviour.

Finally, Segato et al. present several cases where failure occurred during the construction of a long section of the new National "Ionica" Road in stiff, jointed Pliocene clays. As other Italian authors have observed in the past, bedding planes and joints play a fundamental role on slope stability.

These papers present a useful collection of data and knowledge about landslides in hard soils and weak rocks. We should be aware that these geomaterials are widespread in the world, more so than many might imagine.

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