



Water – soil interactions and landslides in blue marine clays of Southern Italy

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Water is well known plays a key role in processes of landslides by means of the increase of pore pressure distribution and the decrease of shear strength in incoherent soils, and of the load exerted on the soil mass by seepage forces.

Water is also the dominant factor that allows the salt circulation in soil masses, going to affect the dynamics of other two of interacting possible mechanisms with the soil structure and soil strength: the osmotic swelling in fine grained soils and the variation of cementation in sands, coarse grained soils and soft carbonate rocks.

The osmotic swelling (or shrinkage), a relevant phenomenon of the marine clays as the “sub-Apennine” blue clays, a widespread kind of soils constituted by stiff fissured clays with medium to high plasticity, present in the southern regions of Italy, depends on the interactions of the ionic concentrations between the interstitial water and boundary waters, exposed to meteoric freshwater for a long time.

The variation of cementation can occur in these climatic regions mainly by precipitation or solution of carbonate salts in soil masses characterized by significant groundwater level fluctuation, with long periods of saturation and unsaturated long periods of capillary heads.

This study concerns two cases of landslide instability, associated to the osmotic swelling process of blue clays, the first near Lucera (FG) in the northern part of the Apulia region and the second near Tolve (PZ), in the northern part of the Basilicata region.

Lucera landslide is a shallow landslide located on the northern flank of the hill which hosts on its top the town. About 50 years ago, the lower part of the hillslope involved in clay quarrying for brick production was profiled and a big excavation was made at the toe of the slope, of a depth of about 18 m . The excavation was filled with potsherd mixed with other remains of the manufacture of the bricks and full saturated with freshwater. The complete filling of the big hole prevented for long time the knowledge of its presence and allowed other interpretations about the instability phenomena.

The swelling effects coming from the long time interaction between marine clays and freshwater was established by means of squeezing of soil samples taken at different depth in some boreholes and the subsequent analysis of the extracted water. Combined effects of the hillslope toe excavation and of the strength reduction around it, leads to the development of a number of shallow landslides, spread from the toe to the top of the hillslope.

The second case, near Tolve town, concerns a slope cut near the toe by a small trench of a road. Herein, the blue clays have bedding planes about 20 degrees sloping towards the toe. An evident bulging of the road plane and tilting of the side walls of the trench started some years after the road construction, 25 years ago. Years after, the development of a number of shallow landslide and the formation of a not well developed crown of the landslide, was revealed. Afterwards, geotechnical surveys confirmed the strong capability of swelling of the involved clays. The instability is still active at the toe in the form of heave of the basement of the trench and of strong deformation of the upward supported side wall.