



Weathering-landslides relationships in the catchment of the Mucone River (Sila Massif, Calabria, Italy)

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The Calabria region of southern Italy is well known as one of the most landslide-prone areas in the Mediterranean basin, due to a number of predisposing and triggering factors. Among the latter, earthquakes and intense and/or prolonged rainfalls play the leading role in causing development of first-time landslides, and re-activation of old slope movements. As regards the predisposing factors, weathering processes are of extreme importance, and often result in transforming the crystalline rocks into soils showing poor to very poor resistance to failures. The catchment basin of the Mucone River, a right tributary of the Crati River, is located in the Sila Massif (northern Calabria), and has been studied since several decades with regard to weathering. In the attempt to get better comprehension of the likely relationships between distribution of weathered materials on the slopes and development and activity of landslides, we focused our attention on the middle sector of the catchment, in the proximity of the town of Acri. Selection of this area was dictated, beyond the relevance of the weathering processes on the gneiss there cropping out, by a long history of instability, documented since the 16th century. Field survey of the weathered rocks was performed following the six-fold scheme proposed by the Hong Kong Geotechnical Control Office (1984, 1988): four different weathering-grade horizons were identified, from moderately weathered gneiss (grade III) to residual and colluvial deposits (grade VI). At the outcrop scale, the most represented grades of weathering are grade III and grade VI, followed by lower presence of grade IV (highly weathered gneiss) and grade V (completely weathered gneiss). As in several other sectors of the Calabrian massifs, in the Mucone catchment the weathering profile is complex, showing a great variability in both the vertical and lateral sense. Complexity of the weathering profile

is further accentuated by corestones of more resistant material embedded within the more weathered deposits. Nevertheless, some differences have to be pointed out between the slopes of the Mucone catchment: the right slope presents wide sectors with highly and completely weathered materials, and, on average, the rocks appear to be more weathered than on the left slope. This difference in weathering corresponds also to the spatial distribution and the state of activity of slope movements: active landslides prevail on the right slope, where mainly the grades V and VI of weathering materials crop out. More ancient gravitational phenomena, on the other hand, are frequent on the opposite (left) slope, which is mostly characterized by highly and moderately weathered gneiss (grade IV and grade III, respectively). As regards landslide typology, at those sites where weathering has not worked deeply, small, often unmappable, rock falls have to be recorded. The most weathered rocks, including the residual deposits, show on the other hand a greater variability of slope movement types, from soil slips, to slides, to debris flows, and to complex slope movement deriving from combination of two of the types above. Integrated analysis of the weathering map and the landslide inventory map allowed to identify the relationships between presence of weathered materials, morphology and source areas of landslides. Furthermore, elaboration of the data collected from the different phases of work, and their implementation in a GIS environment, made possible to evaluate the landslide susceptibility in the selected stretch of the Mucone catchment, as the first step in the process of mitigation of the landslide risk.