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Influence of graphite and serpentine minerals along landslide failure surfaces

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Landslides and deep-seated gravitational slope deformation (DSGSD) often are concentrated in sedimentary and metasedimentary rocks (e.g. Ambrosi and Crosta, 2006) and in carbonaceous materials (CM), where weaker slip surfaces can be generated more easily, with a behaviour similar to that of fault zone (e.g. Zulauf et al., 1990; Craw, 2002; Oohashi et al., 2011, Nakamura et al., 2015). Among the carbonaceous minerals, graphite (grouped with other silicate sheet minerals) acts as a "solid lubrificant" and plays a key role on frictional properties of the slip surface (Yamasaki et al., 2015). These minerals have one key characteristic in common: the presence of weak bonding along (001) planes. Graphite also has one of the weakest bonding in the crystal structure, and it is characterized by a markedly low coefficient of friction (ca 0.1). A similar behaviour is found in serpentine minerals series and chlorite.
We performed these tests on different samples derived from Mont de La Saxe landslide and Chervaz landslide. The first one is located in the upper Aosta Valley, the second in the central part of the Aosta Valley. Both these landslides are characterized by metasedimentary sequences. The undisturbed samples derived by core recovery surveys.
We performed a petrographic characterization by XRD (X-Ray Diffraction), XRF (X-Ray Refraction) and SEM (Scansion Electron Microscope) with microprobe in addition to laboratory tests on samples from shear zones. Along these shear zones grains are crushed, their size and shapes are changed and these changes necessarily affect pore-water pressure due to volume change in the shear zone.
We performed tests using a dynamic-loading ring-shear apparatus (DPRI-5, Sassa et al., 1997). This apparatus allows to simulate the entire process of failure, from initial static or dynamic loading, through shear failure, pore-pressure changes and possible liquefaction, to large-displacement, steady-state shear movement. It is also possible to simulate the formation of the shear zone and the post-failure mobility of high-speed landslides, monitoring pore-pressure generation, and mobilized shear resistance together with shear displacement.

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