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Geomechanical characterisation of Liro and Livo lithologies (northern Lake Como, Italy): the first report

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The geomechanical characterisation of rock masses is an important step in any geological hazard study. In Liro and Livo catchment basins (northern Lake Como, Italy) rock masses are made up of different materials, frequently tectonically disturbed. In fact, the structural setting of the basins is strongly influenced by the presence of the E-W Tonale fault and by its related lineaments that cross the area. The Tonale fault is a Tertiary right-shear fault that divides the central part of the Alps from the Southalpine domain. Several studies examining the geomechanical properties of heavily fractured rock masses, especially fault zones, have shown that rock strength and deformation parameters vary depending on the different structural characteristics (e.g. fracture density) within the zone itself. In Liro (56 km2) and Livo (47 km2) basins a large number of rock slope instability phenomena and debris flows are present, often involving sheared rock masses. In order to derive more information with respect to the in situ scale rock mass properties and their variance across the shear zones, the Geological Strength Index (GSI) was estimated on 51 outcrops of limestone, gneiss, granodiorite and schists, and successively, the Hoek-Brown strength parameters were derived. On the same stations a structural survey (slikenside lineations) was also carried out. GSI is obtained by combining two characteristics: the rock mass structure and the surface conditions of discontinuities, and it is estimated from visual examination of the rock mass exposed. Since tectonically disturbed rockmass are the sources of material for debris flow, rockfalls and rockslides in the study areas, the first approach utilised was a geomechanical characterization of the lithology and a preliminary assessment of its relationship with the main structural feature. In fact, studies examining the geomechanical properties of such heavily fractured shear zones and fault zones and relating these properties to the local structural setting are rare: in this context it is important

to characterize the lithologies to predict their behaviour. Geomechanical data allow to say that the GSI values are not directly influenced by the Tonale fault but only by its secondary lineaments, that have a direct action in the shape of the basin hydrographic pattern and in the location and development of debris flows. In limestone and granodiorite the GSI values are generally high (65-70), but they become rather low (limestones 30-35 and granodiorites 35-38) just in correspondence with debris flow initiation/channel zones. In gneiss the GSI range is wide (55-14) and related to both weathering conditions and schistosity degree. Locally, schists (varying from strong micaschists and calcitic schists to weak chloritic, talc-rich schists and phyllites) are characterized by very low GSI values.