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The influence of tectonics in rock slope deformation: A review

Florian Humair (1), Andrea Pedrazzini (2), Michel Jaboyedoff (3), and Jean-Luc Epard (1)

(1) Earth Sciences Institute, University of Lausanne, Switzerland (ISTE) (florian.humair@unil.ch), (2) Office cantonal de l'environnement, canton du Jura , (3) Center of Research in Terrestrial Environment, University of Lausanne, Switzerland (CRET)

Many factors influence and affect the development of rock slope deformations, either by predisposing slopes to failure or by triggering the failure leading to the final collapse. These factors include the inherent slope's parameters (structural settings, lithology, groundwater, slope morphology, ...) and the external parameters that independently influence all slopes of a region (given by the seismicity, climate, gravity, ...). Most of the relevant literature on rock slope deformations comprises studies of individual events and mainly deals with trigger mechanisms, rock mechanics, numerical modelling of failures, morphological evidences of failures, runout simulations and rock slope deformations classifications.

Here we focus on the importance of the roles played by the tectonic on the development, the mechanisms, the spatial distribution, the size and the propagation of large massive rock slope failures. As highlighted by many authors in different mountain belts, tectonics is considered as one of the key parameters influencing the development of rock slope deformation.

This critical review examines and exposes the links existing between both "active" tectonic (neotectonic) movements and "passive" tectonic (inherited tectonic structures) and rock slope deformation in terms of predisposing and trigger factors. Active tectonic movements play a direct role by triggering the collapse of rock slope failures or by reducing the rock mass strength due to development of tectonic fracturing. At all spatial scales, the development and the characteristics of massive rock slope failures are frequently linked to the presence and the characteristics of inherited ductile and brittle tectonic structures. Indeed, besides creating favourably oriented weakness's planes which are potentially reactivated by gravitational movements, the importance of tectonic inherited structures on the rock mass strength reduction has also to be considered.

Through this review, we highlight and exemplify different aspects of the close links between tectonics and rock slope deformation based on a large number of Late Quaternary study cases.