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On the processes of detachment in rock slope failure

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The failure of steep hard rock cliffs requires that a set of processes occur that allow detachment of one or more blocks from the rock mass. Whilst in general terms we understand the nature of these processes (reduction in strength of existing discontinuities through weathering; pore pressure generation; processes associated with temperature changes, sometimes in the presence of water; fracturing; etc), and the controls upon them, the specifics of their mechanisms remain rather elusive. The consequence is that models of the evolution of rock slopes, and the development of predictive tools for rock slope failure, remain rather basic and unsatisfactory for most environments. In this paper, the results of a range of studies on the behaviour of rock slopes and rock masses, both in the field and in the laboratory, are integrated to examine our state of the art in terms of understanding detachment. Use is made of understanding of time dependent and stress dependent rock failure mechanisms. Particular focus is paid to the relationship between fracture and rock slope collapse, and the role that external and internal processes play in driving failure. It is shown that during the development of final failure control on the rock mass processes increasingly transitions from external agents to internal dynamics. This provides a potential way in which to classify the evolution of failure and thus to predict the time of the final event, paving the way for improved warning systems.