Geophysical Research Abstracts
Vol. 12, EGU2010-1500-1, 2010
EGU General Assembly 2010

Characteristic features typical of large-scale non-volcanic rockslides and rock avalanches: indication of their motion mechanism

Alexander Strom
Institute of Geospheres Dynamics of Russian Academy of Sciences, Moscow, Russia (a_strom2002@yahoo.co.uk)

Large-scale rock slope failures, both sector collapses on volcanic edifices and non-volcanic rockslides are among the most disastrous natural phenomena. Rock and debris avalanches produced by such collapses affect vast areas extending many kilometers from the source zones. Prediction of the endangered zone dimensions needs better understanding of motion mechanisms, which can be derived, in particular, from the thorough study of the deposits of past events internal structure and morphology. Generally, non-volcanic phenomena are simpler, being governed by fewer factors than sector collapses associated with volcanic eruptions. Thus processes driven by gravity force that undoubtedly plays an important role in the formation of all types of rock/debris avalanches can be derived from interpretation of such case studies, especially of those that originated on slopes composed of several types of rocks. Structural peculiarities typical of most of large-scale non-volcanic rockslides and rock avalanches are: preservation of the initial rock types succession in final debris or its transformation into pseudo-stratified body; dual-zone internal structure of rockslide/rock avalanche bodies with intensively crushed lower parts overlaid by coarse blocky carapace. Transformation of the original sequence of rocks into pseudo-stratified 'pilau-like' bodies with unmixed 'layers' of debris can be exemplified expressively by several case studies from the Tien Shan Mountains. Such internal structure differs significantly from the real retention of the original rock sequence first described by Albert Heim. Lower portions of debris originate from rocks that came from the lower part of the slope (of the source zone) and undergo intensive comminution, while overlying 'layers' that came from uppermost part of a slope form coarse blocky carapace.
Besides, analysis of debris morphology allows assumption that momentum transfer occurs from rapidly decelerating portion of debris that accumulates at the proximal part of the deposition zone to its portion retaining possibility of further motion. Many rock avalanches are characterized by 'dual' morphology with large portion of debris accumulated at its proximal part, while other portion forms long-runout 'secondary' avalanche. Characteristic feature of most of such rock avalanches is a concave slope of the compact proximal part of debris accumulation rising above the avalanche-like part (the so-called 'secondary scar'). Another type of the 'dual-portion' rock avalanches with compact and highly mobile parts, but without pronounced 'secondary scars', marking their boundary occur when rapidly moving debris enters sharp valley narrowing ('bottleneck' effect). It results in abnormally long runout of that portion of debris that had passed through such 'bottleneck'. Both types of secondary rock avalanches are exemplified by case studies from the Tien Shan. It is likely that same mechanisms can work during volcanic debris avalanches formation.