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Relevance of dating deep seated mass movements: evidence from the Holocene Fernpass-rockslide (Northern Calcareous Alps, Tyrol, Austria)

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Large landslides constitute spectacular geologic hazards, occasionally affecting potential settlement areas. Improved knowledge about the temporal evolution of slope failures is essential for understanding collapse processes. One of the largest alpine mass movements is the fossil Fernpass-rockslide in the Northern Calcareous Alps (Tyrol, Austria) with a total volume of approx. 1 km^3, made up by two channelled and diametrically opposed “sturzstroms” up to 16 km length. Moreover this catastrophic mega-event was accompanied by a secondary rockslide and an unstable slope representing an initial stadium of a rockslide. So far, the geological cause, the triggering and the age of failure of the Fernpass-rockslide have been unsolved.

Lithological parameters of the incompetent and low permeable Seefeld Fm (Upper Triassic) and bedding conditions, but above all, complex intersection of fault systems and fracture zones are responsible for the occurrence of several fossil mass movements in this region. Strong earthquakes close to the Fernpass are among the most intense ones ever measured in Austria and suggest here a neoteconical predisposition of deep seated slope failures. Seismic active fault systems can produce intensely fractured rock masses to substantial depths, including potential sliding planes of mass movements, and influence the hydraulic flow field, but also trigger mass collapse.

Since previous attempts of dating mass movements in the Eastern Alps relied predominantly on morphological criteria, many of them - including the Fernpass-rockslide - were supposed to have been in contact with late-glacial ice. Therefore these slope instabilities were attributed to fluvial-glacial erosion and valley deepening, which caused

stress redistribution and uncovered favourable oriented sliding planes. At Fernpass field investigations and drillings show that the debris of the northern branch partially rests on moraine, whereas the more mobile southern sturzstrom surged on fine-grained lacustrine sediments of a late-glacial bottom set (Prager 2005, this session). Neither the deeply incised, wedge-shaped scarp nor the Toma-hills of the accumulation area show any glacial overprint. However, the age of failure was formerly discussed conflictive and only since application of radiometric dating methods on mass movements in the nearby areas a younger Holocene age of the Fernpass-rockslide was assumed (Abele 1991, 1997).

Considering the complex Fernpass-rockslide might imply several failure events, absolute age-dating is the obligatory method to establish a coherent chronology. Here the geological situation enables the application of (1) ^{14}C-dating of organic substance in rockslide-dammed torrent deposits, (2) Surface exposure dating of bedding-parallel large-scale sliding planes with cosmogenic nuclide ^{36}Cl and (3) U/Th-dating of vadose carbonate cements in rockslide-interspaces. Preliminary the release of the Fernpass-rockslide is assumed to be a historic event with a minimum-age of approx. 3500 uncal. yrs BP.

Compiled data of landslides in the Eastern Alps suggest that postglacial slope failures date at least into two striking age-clusters - one about 10.000-8500 uncal. yrs BP and another, clearly not linked with deglaciation processes, about 3700-2900 uncal. yrs BP. This temporal distribution coincides with the progradation of some larger debris-cones in the nearby main valleys (Patzelt 1987), indicating climatic phases of raised precipitation. Based on this, deep-seated mass movements show evidence of climatically controlled groundwater flows and water pressure changes within the fractured rock mass. Remarkable, some radiometric data indicate reactivations of predetermined vulnerabilities, causing repeated slope failures. In conclusion, it is the polyphase interaction of lithological - structural vulnerabilities, seismic activity and climatic influences that can induce deep seated mass movements.

References:

Abele, G., 1991: Der Fernpaßbergsturz - Eine differentielle Felsgleitung. - Österr. Geograph. Ges., Zweigver. Innsbruck, Jhrber. 1989/1990, 22-32.

Abele, G., 1997: Rockslide movement supported by the mobilization of groundwater-saturated valley floor sediments. - Zs. Geomorph. N. F., 41, 1-20.

Patzelt, G., 1987: Untersuchungen zur nacheiszeitlichen Schwemmkegel- und Talentwicklung in Tirol: 1. Teil. Das Inntal zwischen Mötz und Wattens. - Veröffentl. Mus. Ferdinandeum, 67, 93-123.

Prager, C., 2005: Kinematics of a long run-out rockslide: a case study from the Fernpass-region (Northern Calcareous Alps, Tyrol, Austria). - Abstract and Poster, presented at EGU Gen. Ass. 2005, Vienna.