Geophysical Research Abstracts
Vol. 17, EGU2015-10907, 2015
EGU General Assembly 2015

Relating rock avalanche morphology to emplacement processes

Anja Dufresne (1), Christoph Prager (2,3), and Annette Bösmeier (1)

(1) Geology, Universität Freiburg, Germany (anja.dufresne@geologie.uni-freiburg.de), (2) alpS GmbH, Innsbruck, Austria, (3) ILF Beratende Ingenieure ZT GmbH, Innsbruck, Austria

The morphology, structure and sedimentological characteristics of rock avalanche deposits reflect both internal emplacement processes and external influences, such as runout path characteristics. The latter is mainly predisposed by topography, substrate types, and hydrogeological conditions. Additionally, the geological setting at the source slope controls, e.g. the spatial distribution of accumulated lithologies and hence material property-related changes in morphology, or the maximum clast size and amount of fines of different lithological units.

The Holocene Tschirgant rock avalanche (Tyrol, Austria) resulted from failure of an intensely deformed carbonate rock mass on the southeast face of a 2,370-m-high mountain ridge. The initially sliding rock mass rapidly fragmented as it moved towards the floor of the Inn River valley. Part of the 200-250 x 106 m3 (Patzelt 2012) rock avalanche debris collided with and moved around an opposing bedrock ridge and flowed into the Ötz valley, reaching up to 6.3 km from source.

Where the Tschirgant rock avalanche spread freely it formed longitudinal ridges aligned along motion direction as well as smaller hummocks. Encountering high topography, it left runup ridges, fallback patterns (i.e. secondary collapse), and compressional morphology (successively elevated, transverse ridges). Further evidence for the mechanical landslide behaviour is given by large volumes of mobilized valley-fill sediments (polymict gravels and sands). These sediments indicate both shearing and compressional faulting within the rock avalanche mass (forming their own morphological units through, e.g. in situ bulldozing or as distinctly different hummocky terrain), but also indicate extension of the spreading landslide mass (i.e. intercalated/injected gravels encountered mainly in morphological depressions between hummocks).

Further influences on its morphology are given by the different lithological units. E.g. the transition from massive dolomite/limestone sequences to weaker siliciclastic and evaporitic beds (sand-/siltstones, rauhwacken) can be pinpointed on LiDAR shaded relief images of the rock avalanche deposit. Hence, several morphological signatures are clearly related to differences in mechanical behaviour of the involved lithologies, whereas others reflect particular emplacement modes of the same rock unit: e.g. rockslide motion versus rock avalanche spreading.

Reference

Patzelt G. 2012. The rock avalanches of Tschirgant and Haiming (Upper Inn Valley, Tyrol, Austria), comment on the map supply. (German language only). Jahrbuch der Geologischen Bundesanstalt 152(1-4): 13-24.