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Evidence of rock avalanche emplacement dynamics recorded in grain size distributions and grain shape descriptors

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The fragmented deposits of large rock avalanches and rockslides contain evidence of many overlapping factors known to contribute to their emplacement dynamics. Source structures and stratigraphy, material properties, topographic interference, substrate interactions, and finally the specific emplacement processes all shape the final deposit fabric. Recent advances in the sedimentological study of rock avalanche deposits established an overall three-part facies-division of an upper, coarse carapace, a heterogeneous body, and a basal facies (Dunning and Armitage 2011; Dufresne et al. 2016). Within the body facies, a number of sub-facies exist that vary between deposits and are variably linked to the contributing factors listed above. To reduce influencing factors and narrow down on the dynamic, internal emplacement processes, largely mono-lithologic deposits (Tschirgant, Austria; Flims, Switzerland) were selected as case study sites. Furthermore, the effects of external influences (topography, substrates) were reduced by selecting sites within the deposit interior, and by basing sampling for grain size and grain shape analysis on detailed facies mapping. Characteristic grain size distributions of interior sub-facies can be linked to specific processes acting during emplacement. From simple breakage along pre-existing planes (jigsaw-fractured facies), through dynamic fragmentation (fragmented facies), to zones of shear concentration (shear facies). These changes in processes are furthermore recorded in specific grain shape descriptors across facies and grain sizes. No exotic emplacement mechanisms are required to produce these features; continued, heterogeneous degrees of fragmentation of an initially intact source rock best explains the sedimentary record of rock avalanches.

References

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