INQUA 2019 DUBLIN IRELAND
25th - 31st July 2019

O-4190

Interactions between landslides and glacier advances during the Alpine Lateglacial of the Eastern Alps

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Abstract

Glacial erosion during the Alpine Last Glacial Maximum (AlpLGM) resulted in an enhanced relief with oversteepened slopes. The classical textbook view of mass movements starting after ice-decay during the Alpine Lateteglacial (ALG, c. 19-11.7 ka) has been challenged by the increased number of numerical dates of rockslides and rock avalanches. Most of the dated catastrophic rock slope failures occured during the Holocene and only a minority are of ALG age. However, systematic geological fieldwork accompanied by several dating techniques showed complex, direct and indirect links between glacial and gravitational processes during the ALG. Paraglacial rock slope failures had in some cases a considerable impact on glacier dynamics during the stadials. This includes (1) landslide-dammed lakes and their influence on glacier advances and (2) debris-covered (or mantled) glacier systems due to rock avalanche activity during glacier advances resulting in the formation of huge moraines and in large palaeoglacier extents. In addition, such an impact results in (3) changes of the valley topography and, hence, in very different conditions for following glacier advances compared to previous ones.

Based on recent geochronological data, especially results of surface exposure dating with cosmogenic nuclides, this contribution demonstrates the impact of various paraglacial mass movement-types (deep-seated gravitational slope deformations, rockslides and rock avalanches) on the landscape and on glacier advances. The record of gravitational processes covers the period from the onset of deglaciation during the phase of ice-decay (20-19 ka), the Gschnitz stadial (17-16 ka) and the Egesen stadial (Younger Dryas, 12.8-11.7 ka).

The examples also show that gravitational deposits could serve as an excellent marker to improve the stratigraphy of the ALG considering the whole landscape evolution since the AlpLGM.