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Timing and distribution of postglacial rockfalls in western Norway

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A high number of rockfalls have occurred within the mountainous fjord landscape in western Norway during its geologically recent past. However, neither the temporal patterns of these rockfalls nor the specific causes have yet been systematically investigated. The focus of this study is (i) to reconstruct a chronology of rockfalls within two defined and lithologically mostly homogenous study areas (Nord- and Sognefjord) and (ii) to identify the likely triggers and controlling factors of those rockfalls.

The inner parts of the Nord- and Sognefjord systems located closely to the Jostedalsbreen ice cap in western Norway have been selected as study areas. A number of 48 potential rockfall test sites have been selected to date with nine identified age- control points (moraines and bedrock outcrops of known age) available for this study. First investigations have started by applying Schmidt-hammer exposure-age dating (SHD) at seven larger rockfall deposits as well as at five moraines of known age within two steep, parabolic-shaped and glacier-connected neighbouring drainage basins, Erdalen (79.5 km2) and Bødalen (60.1 km2), both located in inner Nordfjord. At each site, 50 to 100 impacts using a mechanical Proceq N-type instrument were sampled from the surface of 5 to 50 individual rockfall boulders located at the outer margins of the rockfall deposits. In order to avoid sampling of more recent rockfalls or redistributed debris material, the sampling strategy applied preferred a high number of individual boulders sampled with few impacts each against sampling few boulders but with a higher number of impacts. First results show that the mean Rebound (R-) values measured at the seven rockfall deposits fall into significant different age ranges. Based on the SHD measurements obtained from the moraines and one additional control point, the determined rockfall age ranges are spread between the Preboral (with Schmidt-hammer rebound (R-) value means and 95% confidence intervals ranging from 39.7±2.0 to 45.2±1.4) and the "Little Ice Age" (with R-values ranging from 54.0±1.8 to 60.0±1.8). The control point, a glacially scoured bedrock surface located within the Bødalen valley length profile that is considered being exposed following regional deglaciation (ca. 9700 years ago) provided an R-value of 35.6±2.4.

To establish a chronology of postglacial rock-slope failures a combination of different relative and numerical dating techniques will be applied (multi-proxy approach). The controls of selected postglacial rockfalls will be explored using detailed geomorphological mapping combined with hillslope morphometry analyses and investigations of lithological and structural rock properties.