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The giant Lukla and Khumjung-Namche rockslides – implications for quaternary landscape evolution and consequences for landuse (Sagarmatha National Park, Khumbu Himal, Nepal)

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The giant Khumjung-Namche and Lukla Rockslides are located in the steep Khumbu Himal (Nepal) within the probably most impressive mountain catchment on earth drained by the Dudh Kosi River (1560 km^2, altitudinal range 1341-8848 m). Both rockslides are of considerable size (each deposit ca 5.5 km^2) but so far just barely described, partly misinterpreted and widely unknown.

The aim of this study is twofold: First, the rockslides bear the potential to bring more light in the debate about the timing and extent of the LGM in the region, since both are of considerable age (huge parts of the masses have already been excavated) but none of them show signs of post-depositional glacial modification. Second, both deposits provide a gentle topography and the most extensive areas for settlements in the region (with the centres of Lukla and Namche Bazar) - a fact that demands for hydrogeological analyses of the rockslide material and consequences for landuse and (drinking) water availability and quality.

The study is based on a bundle of methods, including the interpretation of orthophotos and digital elevation models, geomorphologic field mapping, mapping and analyses of rockslide outcrops, spring water sampling and analyses, as well as surface exposure dating (SED) of rockslide boulders and OSL dating of partly preserved fines upstream the rockslides (in progress).

First results for both rockslides include the locations of the head scarps, directions of movement, extents, volumes, and internal composition of the deposits, as well as the timing of the so far undated events. For the southern Lukla Rockslide, SED clearly indicates an age of ca 22 ka BP and confirms a single rockslide event (which was partly interpreted as multiphase event due to its terraced morphology). Samples from the northern Khumjung-Namche Rockslide delivered deviating, but older ages of 50 and 79 ka BP, verifying a pre-LGM event and a maximum LGM ice limit of 4000 m asl in the area.

We further provide first information on hydrogeologic characteristics of the deposits and show that they are composed of fragmented and highly shattered rockslide material that is characterized by effective infiltration, short residence times of percolating water and only small amounts of surface runoff. Subsurface water flow might follow various ways, e.g., along hollows and pipes between the blocks on top, along microstructures or internal sliding planes within the mass, and along the basal sliding plane, especially if controlled by pre-event topography. The topography of rockslide deposits thus facilitates human activity, whereas their internal composition implies a scarcity of water - a critical issue for the local population demanding for adaptation strategies, especially in the light of the increasing tourism in the region.