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Landslide trigger factors on populated, unstable slopes, Tusion, Tajikistan.

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The Pamir region close to the Tajik-Afghan border is regularly affected by severe landslides threatening local population, their livelihood and infrastructure. In addition to landslides appearing as immediate consequence of earthquake, a high number of ground movements without previous seismic activity are also observed. The number of reported events and problem areas has strongly increased within the last ten to fifteen years. Consequently, a study was conducted to determine the triggering factors of these landslides without seismic cause. For accessibility reasons, the community of Tusion, southeast of Khorog, Gorno-Badakhshan, southern Tajikistan, where the capital township is located on a slowly moving slope, was chosen for the pilot project, and geologic mapping as well as seismic refraction and Schlumberger geoelectrics were applied.
The geologic survey showed that the valley flanks around Tusion are covered with large amounts of postglacial and fluvial debris as well as moraine deposits. The absence of glacial ice and the retreat of remaining glaciers caused unstable valley flanks at many sites and, in consequence, extensive gravitational mass movements in the past, which are responsible for the today's layered ground structure as well as many secondary slumps. The latter often damage irrigation lines, which tends to further destabilize the slope.
To obtain an accurate image of the superposed layers, the geophysical survey was conducted on three inhabited flanks. Arguments in favour for those three locations were not only the possibility of direct risk estimation for the region, but also the fact that the number of landslides increases constantly with population growth.
Seismic and electric methods were applied in parallel to distinguish soil types and structural properties as well as to estimate the degree of water saturation.
Despite of the methods' simplicity, they revealed precise explanations on triggering factors of landslides. The geophysical survey showed different density and electric conductivity regimes in the upper layers resulting from exposure and decomposition during the last centuries and especially from uncontrolled irrigation since the 1990s. The electric prospection showed a high water saturation in the weathering layers which is explained on one hand by a higher porosity of the material close to the surface, and on the other hand by the fact that crystalline rocks decompose to clay which, in turn, is able to take up water.
Almost all landslides start in a depth where surveys show firstly a rapid decrease of water saturation, and secondly a transition to more compact material. Thus, it can be concluded that decomposition and irrigation provoke a (re-)activation of sliding surfaces inside the postglacial debris body. The upper layers slide on a humid surface and create the frequently observed landslides in inhabited areas.